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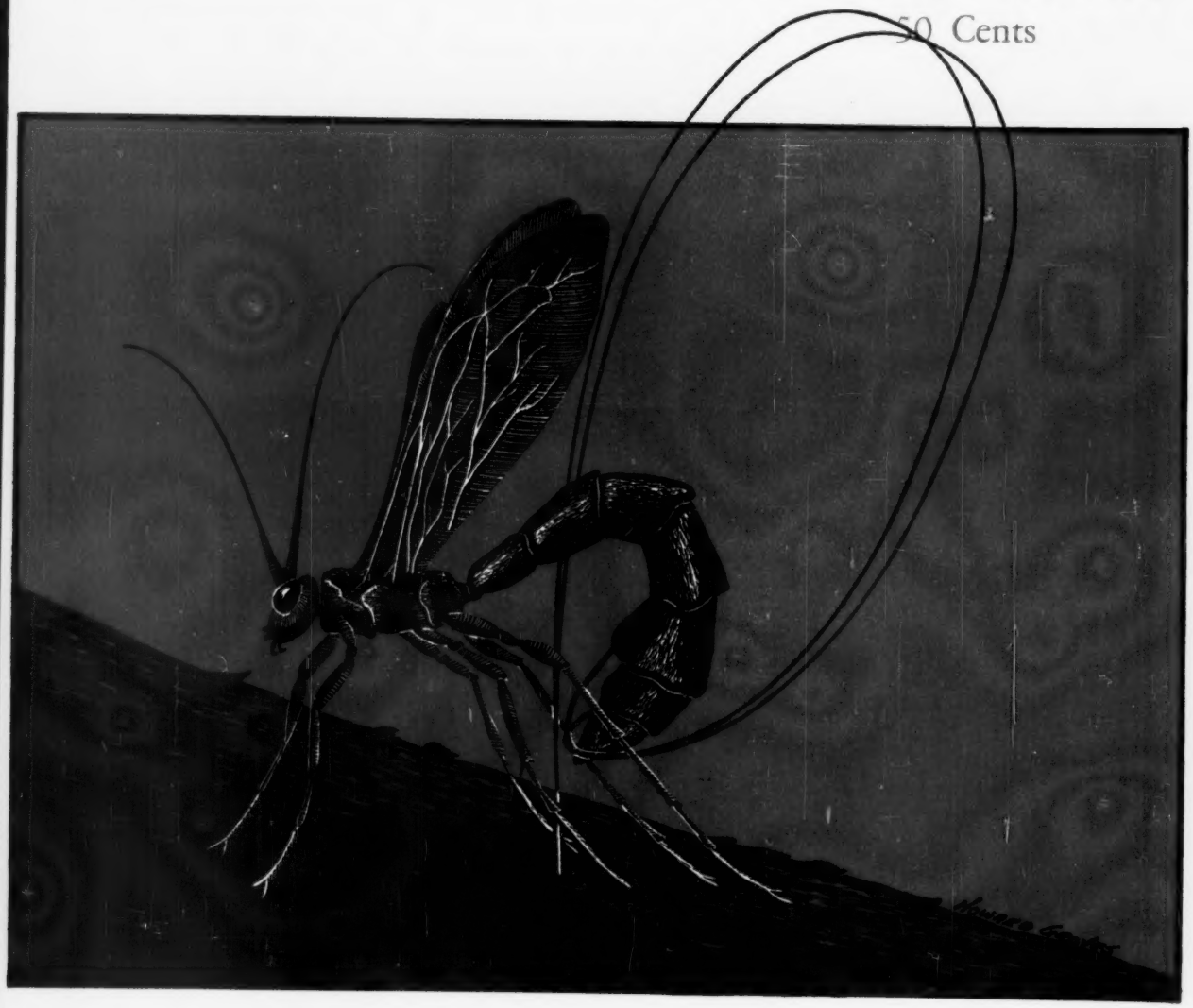

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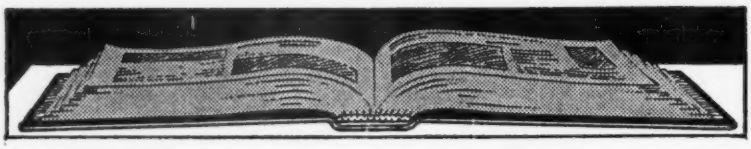

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Reviews

Land

Edited by Alfred Stefferud. Washington, D. C. 1959. U.S. Government Printing Office. 605 pages. Illustrated. $2.25.

This is the 1958 Yearbook of Agriculture, treating with a broad but vital subject. Secretary of Agriculture Ezra Taft Benson points out in a foreword that: "This book will stimulate thought about our land and its use. It will provide much material for discussion." It does, indeed, accomplish these purposes. To the writing of this book, a considerable company has contributed. The chapter divisions are entitled Our Heritage of Land; How We Use and Manage Public Lands; How We use our Private Lands; Some Financial Aspects of Land Use; Rights Ownership and Tenure; Taking Care of What We Have; Our Woods and Templed Hills; These Also Are Our Country; Our Growing Needs and Problems, and Planning for a Better Use. This is an immensely valuable reference work and should, of course, be in every public and private library.

The Senses

By Wolfgang von Buddenbrock. Ann Arbor, Michigan. 1958. University of Michigan Press. 167 pages. Illustrated. $4.00.

Bees, dogs, tapeworms and fleas do not look at the world from a human point of view; each contemplates the real world with its own specially designed senses. How do some animals see with their back, taste with their feet, or smell with their tongues or "read" with their skins? A University of Maine physiologist has attempted to answer these questions by reviewing how the eight senses—and others we did not know existed—work in man and his diverse relatives. Senses involving sight, color, hearing, smell and taste, touch, heat, adjustment of the visual images, gravity and others more obscure, each are discussed clearly and simply so that most naturalists can read the book with pleasure and profit. Illustrated with good line drawings, the book is one of the Ann Arbor Science Library series, which are translations from the German of successful popular science books. It makes it quite clear that man is not the measure of all things. ROMEO MANSUETI

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IN THIS ISSUE

SUBSCRIPTION RATE

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Reviews

The National Forests

By Arthur H. Carhart. With an introduction by Joseph W. Penfold. New York. 1959. Alfred A. Knopf, Inc., 289 pages and index. Illustrated. $4.75.

There are still a great many people who do not understand the difference between a National Park and a National Forest. This excellent book by Arthur Carhart, a companion volume to Freeman Tilden's *The National Parks*, should do much to set these two great properties of the people in perspective. Some think of these 180,000,000 acres in National Forest classification only as a great reserve of lumber; others think of them as a place for a vacation camp; the stockman is chiefly concerned about grazing rights. Of course, the earliest concept was of the forest from the viewpoint of the board feet of lumber that it represented as a national asset. From this limited view has evolved the multiple use concept of the National Forests; their vital importance in watershed protection, for properly restricted grazing, for camping and other recreation, as hospitable homes for many forms of wildlife, as regions in which reposes much of our remaining wilderness, which can be so managed as to preserve substantial examples of primitive America. All these matters Arthur Carhart discusses as he gives the reader a splendid picture of these great areas, what they comprise, how they serve, the problems involved in their management and protection from fire, insect and disease, and the modern view of forestry. Beyond all these considerations, this book is in a sense a guide to the National Forests for a public that travels far and wide. Few motoring citizens will fail to drive within the boundary of a National Forest and it is well that they know its great importance. R.W.W.

Birds of Alaska

By Ira N. Gabrielson and Frederick C. Lincoln. Harrisburg, Pa. 1959. The Stackpole Company. 922 pages. 10 color plates by E. R. Kalmbach and Olaus J. Murie. $15.

Fourteen years of research, field work and preparation have gotten into the making of this monumental volume by two distinguished naturalists and conservationists. It appears as our newest and largest State is taking over the responsibility for its wildlife resources, and this book should serve to emphasize how significant these are in terms of bird life. The book is a Wildlife Management Institute publication and a notable addition to ornithological literature.

Briefly Noted

Whitefoot Mouse. By Barbara and Russell Peterson. New York. 1959. Holiday House. 53 pages. Illustrated. $2.50. A woodland story of night and winter.

A Child's Book of Birds in Rhymes and Pictures. By Helen Vosburgh Smith. Illustrated by Annabelle Forsch. New York. 1959. Exposition Press. $2.00. Introducing youngsters to birds through rhyme and picture.

The Big Insect Mystery. By Lottie Tresner Norton. New York. 1959. Greenwich Book Publishers. 44 pages. $2.00. A story of the woodland for youngsters.

Rock Garden Plants. By Doretta Klaber. New York. 1959. Henry Holt and and Co. 172 pages. Illustrated. $3.95. New ways to use rock garden plants around the home.

Harimau. By Rudolph Yoorhoeve. New York. 1959. John Day Co. 189 pages. $2.95. Fiction for the younger reader about a tiger and a Sumatran village.

Pigeons. By William H. Allen, Jr. New York. 1959. Sterling Publishing Co. 128 pages. Illustrated. $2.95. How to raise and train these birds.

Inside the Living Cell. By J. A. V. Butler. New York. 1959. Basic Books, Inc. 174 pages. $3.50. The latest research findings on "some secrets of life"—heredity, aging, cancer, the processes of the human brain.

Who Lives in a Field. By Duryea Morton. Illustrated by Douglas Howland. New York. 1959. Coward-McCann, Inc. 127 pages. $3.00. For the seven-to-eleven year-old reader interested in common animals of the field.

Let's Go for A Nature Walk. By Joan Rosner. Illustrated by Betty Harrington. New York. 1959. G. P. Putnam's Sons. 48 pages. $1.95. A walk outdoors reveals many interesting things to the young observer.

Nature IN PRINT

By HOWARD ZAHNISER

Bobcat, Otter, and Wolverine

"WHEN THE READER HAS FINISHED THIS BOOK," promises Peter Krott in the preface of his volume called *Demon of the North*, "the wolverine will be familiar to him too—but under the name of 'tupu'." And so it is. Peter Krott, who has taken and reared "a good many young birds and wild animals" for zoological gardens and other wild-animal reserves, not as a hobby, or as a scientist studying animal psychology, "but purely and simply as a way of earning my living," found the wolverine "an unusually interesting little beast." He calls it an "odd" animal and describes it interestingly in the initial paragraph of his preface:

"It is not much bigger than a full-grown fox, but it has the strength of a bear. It usually moves along at a rather clumsy gallop, but the best of the northern long-distance skiers cannot overtake it. The wolverine can't stalk its prey noiselessly; it can't lie patiently in wait; and it can't overtake its victim by superior speed. And yet it is never short of food. Its sight is not particularly keen, nor is its hearing or its sense of smell; and yet even the most skillful and experienced hunter is rarely able to bag it. It gobbles up all kinds of food voraciously, but even strong doses of strychnine cannot kill it. The highest price of any beast of prey in the Far North has been placed on its head, and yet its numbers have hardly decreased."

A secluded life

Peter Krott, who raised wolverines taken in their young days, and later even studied some of them that he released in a sort of controlled wilderness, reports that he "soon realized that the veil of mystery that surrounded the wolverine and his doings, and the bad reputation that clung to him, were due to the fact that he lived a far more secluded life than most beasts of prey and was therefore counted far less often in the hunter's bag." In the wild region of Sweden, where Mr. Krott undertook to study wolverine habits and behavior in natural surroundings, he found himself embroiled in a "tupu war" waged by sportsmen against the wolverines in a manner suggestive of belligerence toward predators in other parts of the world also. Yet the experience that he himself had and shared with the bride that he gains during the times related in this book (and the children that followed) reveals to his readers that the wolverine is a fellow creature indeed. One is reminded of Lois Crisler's acquaintance with the wolverine gained as a result of her "daring" overtures in Alaska, as narrated in her current book *Arctic Wild*. Wild creatures are fellow creatures in our own community—that community of all life to which we belong and of which we should be responsible members.

Walter von Sanden's story of his otter *Ingo*—another recently translated story of a wild creature, a wild predator, taken young and associated with human captors, in Germany—like Peter Krott's *Demon of the North* demonstrates, as Herr von Sanden remarks, that "animals are our friends and often our teachers, if we have time for them." Ingo, purchased in response to a dealer's telegraphed offer, because it had been Von Sanden's wife's "dearest wish to possess an otter," was shipped across Germany, from Yugoslavia to East Prussia, and there rehabilitated in its second home among human beings. This adventure and the reconstructed tale of the animal's earlier experiences in Yugoslavia are the substance of the book *Ingo*.

Ingo, the otter, Von Sanden says at the outset of his story," is not of course a human being, he is an otter; and so from the first day of our being together I have had to apply to him a different standard from that which I apply to people." One recognizes the wisdom in this understanding, and the difficulty, and he sympathizes with the author as he surmises that he will "probably never master it properly." Yet the record of the experience that Walter and Edith von Sanden had with this otter is another document of understanding among fellow creatures.

It seems to make little difference that the volume *Ingo* is a release from the "Junior Books Department" of its publishers, as far as adult appreciation may go. The tale is still engrossing and significant. It opens with the otter's arrival at the home of Von Sandens. It closes with a chapter reconstructing the capture—really rescue—of the young otter as it was being swept in flood down a spring-swollen spring at the foot of the Yugoslavian Alps. It is a story no less satisfying because it can be shared with a boy or a girl, or because it is told in but 102 pages.

Among the values and interests of both *Demon of the North* and *Ingo* are the clear and well-reproduced photographs that illustrate wolverine and otter and other creatures, too, including the authors and their beautiful spouses, and children. But perhaps the chief value of these books, and of such books, is their widening of human sympathy with wild creatures. This seems especially significant as regards the wolverine, so often maligned, so commonly suspected of having a character to be despised and shunned.

Friend of predator

In a somewhat different way, apparently more deliberately, Stanley P. Young, in our own country and within our own recent years, has been developing a better understanding of American predators, but likewise with the sense of appreciation that comes with knowledge and understanding, and with sentiments of admiration and sympathy. The wolf, the puma, the "clever coyote," have been the subjects of Mr. Young's earlier volumes, and now in what he calls "the fourth and final on our larger predators," he writes of *The Bobcat of North America: Its History, Life Habits, Economic Status and Control, with List of Currently Recognized Species*.

This compendium of information, including a technical listing of the "Races of the Bobcat," as well as bibliography, tabulations, and other apparatus of scholarship in mammalogy, is indeed the kind of book indicated by its title and subtitle. Yet it has been compiled and written by one Stanley P. Young—there is only one—and this means that the volume also has a character of its own. One might suggest, for ex-

ample, that as a treatise in mammalogy it might be compared to a series of professional lectures on the subject as they might be delivered in the village barber shop, or with fellow townsmen around the "hot barrel stove of the country crossroads."

Among the data included is the record of a "well-known western stockman" who asked Mr. Young how he had lured a bobcat into the field of a camera for its picture. The stockman smelled the oil of catnip shown him in answer to the question and then exclaimed: "Great gods, that's what must make the wild cat wild!" Included also is the personal reminiscence by Mr. Young of the Mexican experience in which he and Tappan Gregory had lured the bobcat into taking the striking picture that aroused the stockman's interest.

Self-portrait

"To Gregory," writes our author, "a self-taken picture of the prince of predators, the puma, was the sole objective," but Mr. Young himself "wished particularly to find out just what the big cat, as well as the bobcat, looks like when sniffing catnip oil."

The photograph that satisfied this curiosity is among those reproduced in this volume.

Stanley P. Young has not only been a student and scientist with regard to predators. His career in the Federal wildlife agency has also included the direction, over a period of years, of its program for destroying predators, and rodents too, for the "control" of those species that come into competition with man's agricultural and livestock enterprises. He accepts the necessity for such programs as he writes this volume on the bobcat, but he also goes "on record" as being "opposed to the necessary destruction of any animal." And he is inspired to make a significant declaration of a "personal attitude" which is that of "the naturalist who has studied animals from the depths of the ocean, in the rivers and lakes, on coastal plain, valley, and prairies to the tops of our high mountain ranges."

Mr. Young "admits," to use his own words, having "strong humanitarian tendencies and being interested in the health, vigor, mentality, education, prosperity, development, and progress of human beings which populate the Earth." He sees this progress as involving a "coping with predators." "The inquiry which culminated in the monographs on the wolves, puma, coyote, and now *Lynx rufus* therefore has been based upon recognition of man as a member of nature's community," which involves what Mr. Young calls "his primary right. . .to exert himself in making conditions more favorable for humanity," including predator control. But Mr. Young, looking back on his own studies, declares with striking eloquence:

"The motivating force has been sheer love of living things and a desire to learn the fundamental laws and forces which activate and control the movements, the development, and the density of living creatures."

Bobcat, otter, and wolverine—all are predators that have faced much human antagonism, but in these volumes they are dealt with in sympathy and with apparent admiration. These volumes thus have a meaning for readers not only for interest and information but also for the deep understandings out of which are the springs of wisdom and the sources of the universal richness of spirit that provides the capital for our whole community of life on the Earth.

The Bobcat of North America: Its History, Life Habits, Economic Status and Control, with List of Currently Recognized Species. By Stanley P. Young. The Stackpole Company, Harrisburg, Pa., and the Wildlife Management Institute, Washington, D. C. 1958. xiii + 193 pp. (6-1/4 by 9-3/8 in.) with frontispiece in color from a painting by Harold Cramer Smith, 45 photographs reproduced on 20 plates, 10 text figures, 9 chapter-head drawings by Harold Cramer Smith, bibliography, and index. $7.50.

Demon of the North. By Peter Krott. Translated from the German by Edward Fitzgerald. New York: Alfred A. Knopf. 1959. xv + 260 pp. (5-3/4 by 8-5/8 in.), with frontispiece drawing, 2 maps, 39 photographs on 24 plates, note on the author, and note on the type. $5.

Ingo: The Story of My Otter. By Walter von Sanden. Translated from the German by Desmond I. Vesey. New York, London, Toronto: Longmans Green and Co. 1959. 109 pp. (5-3/4 by 8-3/4 in.) with title-page drawing and 26 photographs on 16 plates. $2.50.

OUR JUNE-JULY AUTHORS

Frank A. Tinker

Frank A. Tinker, who has variously been Air Force pilot, foreign service officer, air-line pilot and free-lance writer, lives with his wife and three children at Ogden, Utah, where he produces articles on conservation, international affairs, aviation, and other subjects. . .Romeo Mansueti is a fisheries biologist at the Chesapeake Biological Laboratories at Solomons, Maryland, and a frequent contributor to Nature Magazine. . .Aubrey B. Haines, native of Illinois and resident of Pomona, California, since his youth, is a full-time free-lancer who contributes to a hundred or more magazines and newspapers in the United States and Canada; during spare time, Mr. Haines is partial to reading, classical music, and works of art. . . Barbara B. Paine is an amateur naturalist and article writer of Cambridge, Massachusetts. . . Harold V. Green, writer and student of natural history, is supervisor of the photography-microscopy section of the Pulp and Paper Research Institute of Canada, in Montreal. . . Marian S. Edsall, of Champaign, Illinois, an amateur investigator in the field of Nature study, has contributed to many national magazines, specializing particularly on subjects pertaining to the out-of-doors. . .Bill Geagan is a writer-conservationist who lives in Maine, and is the author of a number of books on the outdoors and its inspiration. . . Dr. Edith S. Clements, who, with her husband, formed the "Clements team" of experimenters in environmental evolution of plants at the Alpine Laboratory in Colorado and the Coastal Laboratory at Santa Barbara, California, was educated at the University of Nebraska. An ecologist by profession, Dr. Clements is a resident of Santa Barbara. . .R. Franklin Dugan is a biologist with the U. S. Soil Conservation Service at New Brunswick, New Jersey.

The Mammals of North America

By E. Raymond Hall and Keith R. Kelson. New York. 1959. The Ronald Press Company. Two volumes. $35.00 the set.

While there have been numerous books on mammals, including field guides, regional and state mammalogies, there has not been an encyclopedia of North American mammals since Baird's publication by the same title in 1858. Twelve years in preparation, this monumental work provides reference to more than 3800 named kinds of mammals found from Greenland to Panama. The authors provide complete information on the taxonomy, distribution and literature of these mammals. Geographic distribution is indicated by some 500 original maps covering species and subspecies. There are 538 drawings of skulls with detailed data, and 186 drawings of typical mammals. Descriptions and habits are included. The senior author, Dr. Hall, is Director of the Museum of Natural History, and Summerfield Distinguished Professor and Chairman of the Department of Zoology at the University of Kansas. Dr. Nelson, his collaborator, served as a research associate at the University of Kansas and for five years devoted himself to studies that culminated in these volumes.

The Life and Letters of Charles Darwin

Edited by Francis Darwin. With a foreword by George Gaylord Simpson. New York. 1959. Basic Books, Inc. In two volumes, boxed. $10.00 the set.

First published in 1888, six years after Darwin's death, *The Life and Letters* have been reissued on several occasions but, nevertheless, have long been out of print. It is therefore appropriate that this latest edition should appear in the year in which we observe the one hundred and fiftieth anniversary of Charles Darwin's birth. Although, of course, there have been numerous biographies of the great naturalist-philosopher, as well as other published letters, notes and essays by him, George Gaylord Simpson points out in his Foreword that these do not "significantly change the picture presented in *Life and Letters*. The other material is of great interest to specialists, but the present portrait remains true, and for most readers, sufficient. Even for the specialist, this is where to begin." Dr. Simpson's introductory pages set the publication of these volumes in perspective, and the chapter on the Darwin Family by Francis Darwin, together with the autobiographical chapter that Charles Darwin wrote for his family and not for publication, lead into the fascinations of the edited *Letters*. Certainly this is the *place to begin*, and it is a happy circumstance that it is now possible to do so through this edition.

Briefly Noted

Plants that Heal. By Millicent E. Selsam. New York. 1959. William Morrow and Company. Illustrated by Kathleen Elgin. 96 pages. Illustrated. $2.50. Plants have been used for various medical purposes through the ages and this account of their curative properties is for the younger reader.

Oliver Pete Is a Bird. By Carroll Lane Fenton and Dorothy Constance Pallas. New York. 1959. John Day Company. Illustrated by Dr. Fenton. 48 pages. $2.75. A story of a parakeet presented to convey the fact that this bird is not just a pretty creature but a real bird.

The Weasel Family. By Charles L. Ripper, New York. 1959. William Morrow and Co. Illustrated by the author. 64 pages. $2.50. Story of the interesting family that includes the striped skunk, otter, marten, wolverine and badger. Written for the 8 to 12 group.

On Becoming a Fly Fisherman. By Alexander Mcdonald. New York. 1959. David McKay Company. 168 pages. Illustrated. $4.50. Practical advice on how to get the most out of fishing for trout with fly rod.

A Guide to Nuclear Energy. By R. F. K. Belchem. New York. 1959. Philosophical Library. 77 pages. $3.75. Concise introduction to nuclear energy.

Dogs Are Such Nice People. By H. W. Kauffman. New York. 1959. Pageant Press. 74 pages. $2.50. A dog-lover writes about dogs, interspersing her text with collected dog poetry.

The Pulse of Radar. By Sir Robert Watson-Watt. New York. 1959. Dial Press. 438 pages. $6.00. The story of the conception of radar and its development and use.

Diamonds. By Herbert S. Zim. New York. 1959. William Morrow and Co. Illustrated by Gustav Schrotter. 64 pages. $2.50. A junior book about this most prized of all gems.

All About Tropical Fish. By Derek McInerny and Geoffrey Gerard. New York. 1959. The Macmillan Co. 480 pages. Illustrated with 100 color pictures and 200 in black and white. $15.00. Guide to the establishment, maintenance and stocking of the home aquarium and the prospective inhabitants thereof.

Contents Noted BY THE EDITOR

"THE LUCKLESS LEGION" is the title that The Travelers Insurance Companies this year give to their annual—and tragic—summary of fatalities and injuries in highway and street accidents. This effective summary of statistics is emphasized by cartoons highlighting the reasons why 36,700 deaths and 2,825,000 injuries swelled the Luckless Legion during 1958. We still look in vain for any evidence of recognition, as a cause of accident, that the distraction of attention by highway advertising and roadside slums, with their confusing lights and obscuring structures, are menaces. Speed is blamed for more than 40% of the deaths and injuries, emphasizing the importance of attention to driving. Yet 95.5% of the vehicles involved were apparently in good condition; 79.5% of injuries from accidents took place in clear weather and 70.1% on dry pavement; 87% involved passenger cars; 85% of the highway accidents were due to driver error. It is our firm belief that a substantial percentage of the driver error is due to lack of complete attention to the serious business of driving, and the other cited statistics, in our opinion, support this conclusion. What we need is a careful, comparative study of accidents on modern highways free of roadside distraction (and there is an increasing mileage of this kind) with highways the environment of which has been prostituted to commercialism, principally the parasitic advertising message.

ACCORDING TO AMERICAN JURISPRUDENCE the accused is presumed to be innocent until proved guilty. This may apply to human beings, but with the "prosecutors" of the United States Department of Agriculture the fire ant gets no such break. The Department has produced a new film entitled "Fire Ant on Trial," and the verdict was "guilty" before the first frame slid along the projector's sockets. If there ever was a propaganda film this is it, obviously designed to justify the expensive eradication campaign that has brought such protest from conservationists. Says the National Wildlife Federation: "Opposition to the fire ant eradication program is mounting as evidence from infested areas shows that livestock and poultry, domestic pets and fish and wildlife are being killed by the pesticide poisons, some of which have a three-year residual effect. The powerful poisons, hydro-carbons which may be accumulated in living tissue, also pose a threat to human life." Take a liberal supply of grains of salt along with you if this film is unveiled for your viewing.

THE AMERICAN TREE FARM SYSTEM will observe a "golden milestone" some time during 1959. Soon the fifty-millionth acre, after inspection and certification by Tree Farm committees in 46 of the States, will be officially on the rolls. Sponsored and spark-plugged by the American Forest Products Industries, this movement was started in 1941 on the suggestion of a West Coast newspaper editor. It is an industry-sponsored program, without dues, assessments or subsidies, in which the landowner protects his trees from fire, insects and destructive grazing, and harvests his trees in a manner that insures repeated crops. Under this program timberland values are not the only asset. Recreation, wildlife habitat, soil and water conservation are also values.

IN AUGUST, 1958, CLARENCE J. RHODE took off, with his oldest son and an associate, for a routine flight over the rugged Brooks Range in Alaska. From this none has returned, and those who have prayed for this popular and beloved conservationist have reluctantly given up hope. Of Clarence Rhode one eminent conservationist says: "Alaska in particular, and the whole United States in general, are better for his having waged the good fight for conservation. . .The wild things of the Great Northland had in him an unparalleled champion. . .And out of his spirit, his indomitable will and his extraordinary ability, came basic philosophy and solid laws which will protect Alaska's fish and wildlife resources for the generations to come." His friends are joining in urging that the newly created Arctic Wildlife Range be named the Clarence J. Rhode Wildlife Range, and words of approval may be sent to Hon. Fred A. Seaton, Secretary of the Interior, Washington, D. C. Also the Alaska Sportsmen's Council has started the Clarence J. Rhode Scholarship Fund to aid wildlife management students at the University of Alaska. Contributions may be sent to A. W. "Bud" Boddy, Box 761, Juneau, Alaska.

NATIONAL FORESTS AND WILDLIFE REFUGES are bearing an increasing percentage of the annual visitor-days of recreation. U. S. Forest Service statistics show that about 86,365,000 man-days of use were involved in the recreational service rendered by the National Forests in 1958. This is an increase of 12 percent above the 1957 figure, and visits to public camp and picnic sites accounted for 40 percent of the visitor-days of use. Smaller in area and in many instances less well equipped for recreation, the National Wildlife Refuges provided 9,000,000 visitor-days of use, only 352,000 of which were for purposes of hunting. Sixty percent of the total use was for wildlife observation, picknicking, swimming and photography, and 36 percent for fishing. These figures emphasize the importance of providing adequately, in point of facilities and management, for this recreational patronage of such areas. Funds available to the administering agencies for this purpose lag behind the demand. R.W.W.

George Peak, in the lead, and Jack Washichek, following, return from a United States Soil Conservation Service snow survey on Peruvian Ridge near Alta, Utah, January 23, 1956.

In many of our western States, summer's prosperity is foretold by

Counting Snowflakes

By FRANK A. TINKER

THE SUN had barely cleared the yellow-gray hulk of Mount Timpanogos, in Utah's Wasatch Range just east of Provo, when we left "Yukon Yvonne," the snow tractor, in a thick aspen glade and took to skis and snowshoes. From here to the course marker—a metal sign indicating the location of snow-test sites—there was nothing but the sibilant whisper of the skis, a weasel flirting his black-tipped tail aloft, a few juncos flickering like shadows among the firs, and snow—huge slides and whorls of snow, with a vast potential for moulding mountains, trees, streams and the lives of men after its own fashion.

The Soil Conservation Service team that I accompanied was only one unit in an army of a thousand men

A snow survey cabin in the Cascade Mountains of Oregon is nearly hidden under a mantle of deep, wet snow.

Two snow surveyors unload a Federal Mount Rose snow sampler and other equipment prior to sampling a snow course identified by the marker in the background.

and a hundred machines this day, coursing the high fields of the western mountains in the all-important business of counting snowflakes. On the results of this remarkable census the people in the valleys and along the slopes of the eleven western mountain States would plant alfalfa early or sugar beets late, empty reservoirs now to contain a later flood, or recruit extra hands to watch for the imminent forest fires of a coming dry season.

Such surveys have been conducted as a coordinated effort by the Soil Conservation Service of the Department of Agriculture since 1935 and, informally, long before that by private agencies or individual States, which still cooperate in the preparation of the final report. Shortly after the turn of the century, some of the surveyors vow, a University of Nevada Latin professor and conservation enthusiast, Dr. James E. Church, spent his honeymoon atop Mount Rose gaging snow depths by day and lighting fires in the evening to let the valley dwellers know that he and his bride were faring well.

Be this fact or fond fable, in recognition of this first survey site the long metal tube that Stan Peterson, chief of our party, now worked carefully into the snow was called the Federal Mount Rose snow sampler. Made of "duraluminum" and tipped with a steel cutter, it has an inside diameter of 1.485 inches—which is not an accidental figure. With this dimension, the weight in ounces of the snow core brought up by the tube equals the number of inches of water standing in that particular pack. Hence the precise figure.

"Forty-one inches," Stan called. "And fifteen ounces." This, minus the weight of the tube itself, meant that there was almost as much water standing on that slope as the valley below received all year, acre for acre. In some nearby areas it was much more, and in the Cascades or high Rockies the drifts pile to twelve feet, which could amount to more than forty inches of standing rainfall stored in these remarkable reservoirs of Nature.

The actual weight of snow, appearing so inconsequential as it falls, is almost frightening as one considers it hanging in such great quantities over the western watersheds. In its first fluffy state, a cubic foot of snow may weigh only six pounds, but in the mountains where it has been packed by wind and crystallized by rain this may increase to thirty pounds. Under every square yard of such compacted mountain snow a full ton of water may lie waiting to bless the land below—or destroy it.

Measuring these drifts, then, was not a job to be taken lightly.

Photographs by U. S. Soil Conservation Service unless otherwise credited.

A snow surveyor demonstrates an emergency shelter that can be made if he should be caught in the mountains during a storm.

Behind Jack Washichek and George Peak, who are securing a snow core, is one of the Utah-designed snow tractors that allow SCS survey parties a greater degree of mobility than do skis or snowshoes.

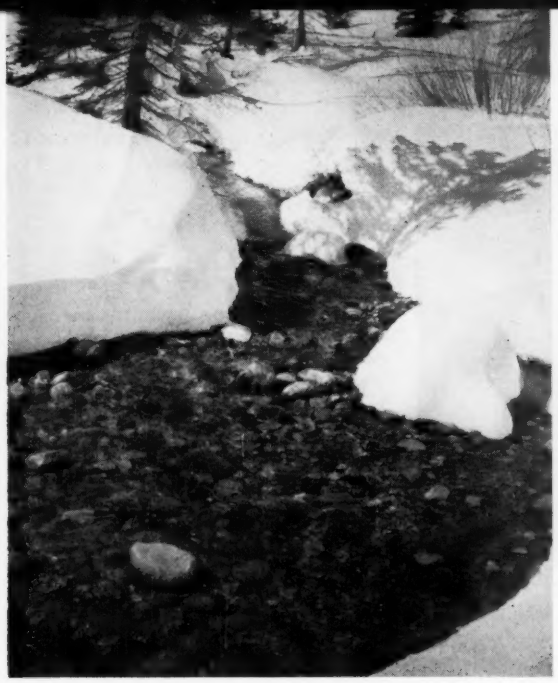
The courses themselves, of which there are 134 in Utah alone, and 1376 in the western system, had been laid out carefully. The particular courses we were following that morning had been completed in 1923 by a young engineer named George Clyde, now governor of the State.

Locating the tall marker in the fir glade, Stan had measured off exactly fifty feet on his tape, heading directly toward the marker on the opposite side of the clearing. Here he took the first core, and others at equally precise spots along the slope. Each site had to be exact in order to obtain a reading that would be meaningful, since the courses are maintained by the Soil Conservation Service during the summer so that stumps and brush will not interfere. Each spot where a sample is to be taken is cleared for about three feet around. If this course had been well sheltered, only one line of readings would have sufficed, but, as it was, the slope was partially exposed and there had been drifting. A T-shaped course thus had been designed to obtain the exact average necessary for accurate estimates.

Young Grant Talbot, a recently graduated hydraulics engineer who was the other member of our party, then consulted the figures for the previous month and found that only a few inches had been added to the snow pack. He shook his head; and as a Utah man, well he might. The figures for this March first date, which can be considered generally about ninety percent accurate for the coming season's prediction, showed that the northern part of the State would have considerably less water draining from the mountains than in the sub-normal year before. Even so, it would probably suffice; but the southern part of the State, which will receive only a little more than half the normal flow this summer, will be in serious straits unless excessive and unexpected rainfall alleviates conditions there.

Two snow surveyors weigh a snow sampler "core" to determine the water content of the snow. The weight of snow in ounces equals the number of inches of water in the particular snow-pack being measured.

The April first readings, which are sometimes ninety-five percent accurate, tell the story. Our figures mostly concerned only the snow at altitudes that would see no appreciable melting before the month of April. The shallow fall at lower levels seldom presents a hazard and cannot be counted as important to the late-summer needs of the valleys, which depend on higher-altitude snow.



Snow in the mountain areas included in the snow survey may reach depths of ten feet or more. Here a small mountain stream struggles through six-foot drifts with precious water for the valley below.

Figures such as we were taking are compiled on the first of each month from January to May, and have been kept carefully since the inception of the program, in some cases for more than thirty-five years. This very continuity of readings is most important, since it reflects all sorts of different conditions that may be repeated in future years. The amount of snow in the pack, although the most obvious part of the survey, is only one of the many variables that are taken into account in figuring the final flow. An early thaw that melts both north and south slopes, spring rains, the condition of the underlying soil—many things can alter the rate of delivery of this water into the valleys. By using the precedents set over these many years of survey, surprisingly accurate predictions may be made.

One new factor that may be added in the future to the strictly natural conditions prevailing on the mountain slopes is snow conservation, which is being tested at the Rocky Mountain Experiment Station at Fraser, Colorado. There, sawdust spread over the snow has provided insulation that retarded the melting of the pack considerably. If it were economically feasible to scatter some such insulation over wide expanses, a more gradual rate of flow might eliminate spring flooding and provide for late summer water when it is most needed. Conversely, a dark, heat-absorbent material like carbon—lamp-black was used in this instance—increases the rate of melt and could stimulate the flow at times when it appeared necessary.

At that particular moment, looking around the white mountain valley, I rather hoped something could be found besides sawdust or lamp-black to scatter over the place, if such scattering were absolutely required. A thoughtful approach to the problem of re-arranging this natural system is mandatory, not only in regard to covering materials, but in the removal of trees, another part of the same experiment. By thinning the growths along these slopes, more room was provided for the snow to fall and pack, and the yield per acre of water was increased. But at a certain point the trees might be found more valuable there than the additional water, particularly if half the mountain started to slide down the gulleys with the melt.

Such things have happened before, and the use of the snow survey figures has helped avoid several catastrophes. In 1952, on the first of February, there was already more snow on the Utah courses than there had been on any previous April day. The inevitable result was easily forecast, and residents were prepared for the

Wayne D. Criddle, Utah State Engineer, and M. W. Nelson, snow survey supervisor of the Columbia Basin, measure off sampling locations on a snow course prior to taking samples.

Two snow surveyors pause for a moment on their way to snow courses in the Cascade Mountains of northern Washington State, where snow frequently piles up to depths of twenty feet or more during winter months.

floods along the watersheds below that came with the first warmth of spring. Several times, in 1950 and 1956, floods along the Columbia River lowlands were held to a minimum by a knowledge of amount and type of snow overhanging the watersheds. Settlement here is particularly exposed, so that millions of dollars have been saved in flood damage alone by such warnings, and the use of all available reservoirs at the proper time.

Not to be measured in money, but certainly of equal value, are the many purely conservational implications of the water supply forecast, which is issued every April. In addition to the obvious effect of abundant moisture upon the humus of the forest floor and the relationship of forest fire danger to the snowfall of the winter before, the grazing privileges on national forest land watered by this snow pack depend largely upon the varying depths of snow. In some of the remote western areas, the only watering places for any purpose are the widely scattered springs. The flow of such springs is carefully watched by rangers and compared with the snow surveys; the predicted flow may govern the numbers of livestock or deer and elk herds that safely can graze the region.

In the valley below us that day was the Great Salt Lake and the world's largest migratory bird refuge, located where the Bear River drains into the northern fresh-water bays. A constant flow of water here is almost indispensable in maintaining the fight against botulism, which may kill half a million birds in a few weeks if allowed to develop. Yet the agricultural users upstream from the refuge have first claim to the water. From these snow surveys the administrators there can know the situation they may face later in the summer, when the river dies and the wide flats of lethal mud are exposed to the flights of waterfowl.

But in February, hanging over us at the 11,000-foot level of the Wasatch range, were billows of warming snow that seemed inexhaustible. On the tremendous slides that dropped away from the peaks there were dark lines where the snow had balled, or a boulder had given way to start a small, warning cascade. On previous years, later in the spring, survey teams had stood in this same spot and watched the full-blown avalanches thunder down for a half-hour at a time.

In belated recognition of this hazard, which nearly every year threatens such survey parties, the Soil Conservation Service has now provided survival gear, and conducts excellent training courses in snow travel. Aircraft are being used more frequently, and snow tractors like our Utah-designed vehicle allow a greater mobility; but more than a third of the 60,000 miles traveled by such teams last year was done by ski or snowshoe. Personnel of the service learn to recognize the long cracks spreading in front of them that can mean dangerous, heavy snow and a possibly disastrous slide.

We finished our snow courses and departed with the computations that would be in the hands of users from Utah to London within a week. But when we left the mountains, guiding "Yukon Yvonne" as she bucked over open terrain and down forest roads that were no more than narrow snow ledges overhanging vertically walled ravines several hundred feet deep, several facts appeared with renewed clarity. First, of course, was the continued importance of maintaining these yearly surveys. The second was simply that these tremendous mountains are far more impressive, grand and lovely in the silence and loneliness of winter, when travel through them is forbidden by the snow, than in the seasons of obscurement and distracting color. Now they were cleanly slate and white, with olive cascades of pine dropping along the hidden water-courses. When Dr. Church was honored for his pioneer work in snow surveying at the Western Snow Conference in Reno, Nevada, last April, the delegates might have felt that Dr. Church deserved their thanks on another score, too. He had provided them with an excuse for visiting those mountain ranges during the winter; not to calculate their value, but to experience it!

Unwelcome "company" for bathers are the

Nettles of the Sea

By ROMEO MANSUETI

Illustrations by Alice Jane Mansueti

EACH year during early summer, "sea nettles," the stinging jellyfishes that long have been infamous along our mid-Atlantic coast, arrive with the same certainty and regularity as death and taxes.

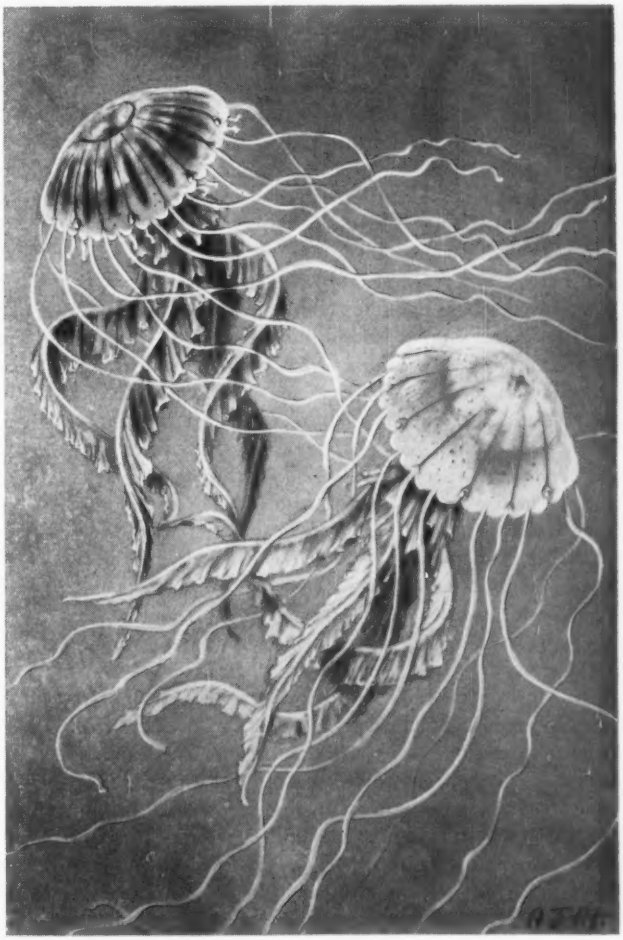
As if man's bottle caps and broken glass were not enough, Nature has provided these pests as company for salt-water bathers. The appearance of these innocuous-looking, fringed umbrellas, with limp icicles trailing below, belies their effect on the lives and activities of vacationists and tidewater resort owners. In spite of the spotlight of attention that is turned upon them annually, their life history is still much of a mystery.

Congressmen and State legislators—especially in the east coast's Chesapeake Bay area, where sea nettles occur in enormous numbers—have debated ways and means of controlling this scourge of the estuaries. They and their constituents recall their experiences while sitting marooned on boats and piers on sweltering mid-summer days, unable to take a dip without the chance of being warmly embraced by sea nettles. To the unitiated, however, jellyfish appear to be the epitome of abject passivity.

Jellyfishes usually are observed languidly pumping away near the water's surface—a typical bay-side scene. Contrary to the surface-floating Portugese man-of-war, this species always swims submerged. Although one might marvel at its intricate detail, actually it is a relatively simple animal, being related to the hydras, sea anemones and other coelenterates. These invertebrates are simple two-layered animals whose bodies and digestive cavities are similar.

When I remarked to a friend that a sea nettle's body is composed of ninety-six percent water, he scoffed at me. He was convinced, however, by the experiment of placing a specimen on the boat deck one windy and sunny afternoon while we were on a cruise. Some two hours later nothing was visible except the outline of the body on the deck, as if someone had sketched a profile of it with a pencil.

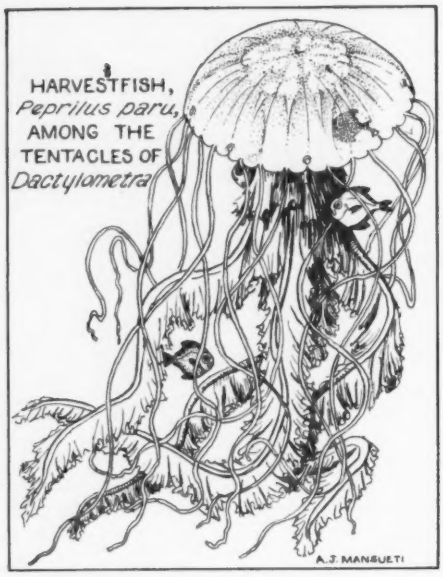
If one can see beyond the animal's translucent beauty and cruel sting, he will note that the radially symmetrical margin of the bell provides the anchor points for twenty-four tentacles and thirty-two scallop-like edges. Although no brain is present, the sea nettle does have a nerve net that serves to coordinate both the pumping contraction of the bell and feeding. It has a mouth, stomach, sex and sense organs, and, as is well known, an apparatus of offense. The stinging cells, or nematocysts which are found on the snake-like tentacles and oral arms that hang down from the center of the bell, pack the punch for jelly-fish.



Illustrated at right are the two varieties of the sea nettle, *Dactylometra quinquicirrha*. At the left is the red-speckled phase that is common within the sea nettle's range—except in Chesapeake Bay—while at the right is the white "stunted" phase that occurs in great numbers in that east coast estuary.

These "stingers" were well described by Kenneth L. Gosner for the Portugese man-of-war in the August-September, 1958, issue of *Nature Magazine*. The sea nettle, incidentally, cannot distinguish between prey and other objects, for it unleashes its venom with equal abandon on pilings, boats, nets, or people that it touches.

"Sea nettles" are so called because of their ability to produce a painful rash similar to that produced by nettle plants. In spite of its tongue-twisting Latin name, it is widely known as *Dactylometra quinquicirrha* along its range from southern New England to Brazil. Most people know it simply as the "jellyfish," although this name is used collectively for many types of medusae.



"Harvestfish and sea nettles seem worlds apart, biologically speaking, and yet together they provide one of the most delightful surprises to be seen in the surface waters of an estuary."

Throughout its range the sea nettle prefers the quiet, brackish waters of shallow bays, estuaries and other inland Atlantic waterways; rarely is it encountered in large numbers in the open ocean. The sea nettles in Chesapeake Bay, for example, are less common in the higher salinities of its lower part where it joins the ocean. Two color varieties are encountered along the coast, and the creatures never cease to mystify the inquisitive swimmer or naturalist.

Scientists have known for some time that the white and red-speckled varieties are one and the same species. The red type, however, is common everywhere within the sea nettle's range except in Chesapeake Bay. In this large estuary the ghost-like, whitish form occurs in prodigious numbers. These are quite remarkable in that, although sexually mature, they are an imperfectly developed or "stunted" phase of the more widely distributed red-speckled jellyfish. Although the latter variety is popularly thought to sting more virulently than the white form, the writer can attest to the fact that they do not differ, since he has been stung by both phases on the same day.

"Where do they come from?" is an oft-repeated question about sea nettles. The notion that they are swept into bays and estuaries from the open ocean is false. In Chesapeake Bay, for example, the nettles are born and bred in brackish areas where the salt condition is not more than one-sixth that of the open ocean. Although they are at the mercy of tides and currents, the nettles are rarely carried far from the point of origin. Scientists at the Chesapeake Biological Laboratory have stained sea nettles with dyes, freed them, and then followed their movements to test this general observation. It is easy to see, therefore, that if control measures ever are used to reduce the numbers of this animal, they can be managed on a local basis.

When biologists want to get to the heart of controlling or exterminating a pest, they look into its sex life. From what is known of Chesapeake Bay sea nettles, males and females mate with a minimum of ostentatious display. Probably attraction and stimulation is enhanced by physical contact and chemical means. Presumably all adults die by late autumn when water temperatures drop; thus the sea nettles never become a year old. In the meantime, the eggs that hatch provide the tiny forerunners of sea nettles, all of which are the result of true sexual reproduction.

Although one would imagine that sexual reproduction would be sufficient to replenish the species each year, the non-sexual form of reproduction is essential in the cycle. The newly hatched sea nettle is an oval-shaped creature covered with hair-like projections that help it move about. It apparently settles to the bottom of a deep hole in one of the brackish creeks close to Chesapeake Bay. Soon it assumes a plant-like form, about one-quarter of an inch high. After over-wintering in this stage, the tiny and now trumpet-shaped body springs to life when the fingers of warm water engulf it. Soon an amazing thing happens. Pieces of its upper body begin to slough off like so many saucer-like disks of jelly. These transform into sea nettles in a short time, float to the surface, and by July are seemingly everywhere.

Sea nettles are not dangerous to swimmers except in rare cases where individuals may be hypersensitive to the protein irritant, or if they are severely stung over much of the body. The latter event may occur if one swims frantically among large concentrations of sea nettles. Under this condition, it is advisable to move away with deliberate care. If you brush against the tentacles or oral arms, the stinging is restricted to the resultant large and painful welts, some of which may blister. The most recommended antidotes are bicarbonate of soda, or ammonia diluted in water, on afflicted areas.

What good are sea nettles? Can anything be extracted or manufactured from them? There is plenty on the debit side of the ledger; little on the credit side. The seasonal loss of trade in certain swimming resorts is said to amount to thousands of dollars each year the nettles abound. Sea nettles fluctuate in abundance from year to year, and since they may be an important cog in the wheel of ecological life, they may be more valuable—or destructive—than the casual observer might think.

I know of a number of biologists who see some good in these jellied devils. Some say that, during certain spring months, the tiny sea nettles may be so abundant in the rich plankton soup of the estuary that they may serve as an important forage for beneficial marine organisms. Other scientists believe that when sea nettles are numerically high, their distant relatives, the transparent sea walnuts of the phylum Ctenophora, become scarce. Ctenophores are believed to feed extensively on oyster larvae. So it is possible that the sea nettles may indirectly protect young oysters. Although this last theory has been advanced by a famous shellfish biologist, it is, as a matter of fact, far from proven.

Although the jellyfish seems like so much "nothingness," the complex protein poison, in addition to traces of protein and salts, is quite substantial and has proved of some value to experimental zoologists. The venom acts somewhat like curare. When injected into small sea animals, it causes paralysis, stops breathing and results in death. In spite of the simple and uncomplicated nature of jellyfish tissues, scientists know that they are built of the same components as those of all animals, including man. For this reason, scientists have used these creatures in general research problems dealing with cellular damage and repair that may ultimately help man.

When I hear the world "control" used in reference to sea nettles, I recall how a well-known Maryland conservation commissioner once dramatically and facetiously introduced his cure. He dropped a live individual into a bucket, announcing that it would soon be dead. Sure enough, it was. His magic substance was fresh water. Actually, he was closer to Nature's apparent answer to the problem than he imagined. We know that during years of low sea nettle abundance, the summers are preceded by extensive rainfall and dilution of the estuary. High jellyfish years are preceded by months of drought conditions. Man will find difficulty in competing with Nature in this type of control.

For all their formidable nature, sea nettles are quite helpless. Wind, waves, tides and entrapment in backwaters may at times kill large numbers. Windrows of dead, stranded jellyfish on the beaches are testimony to the heavy hand of Nature. Although many private and commercial beach owners construct jellyfish nets in early summer, strong tides and winds often pile up and break the gelatinous bodies on the nets. Small jellyfish, of course, are simply pushed through. These nets are a good, but unfortunately temporary, preventive measure. Sea grass, debris, and fouling organisms accumulate on them, and water exchange is interrupted so that a swimming area may become stagnant. And the pieces of tentacles and bodies that sweep in often sting as sharply as live nettles!

Harvestfish and sea nettles seem worlds apart, biologically speaking, and yet together they provide one of the most delightful surprises to be seen in the surface waters of an estuary. The first time I observed how a young harvestfish, *Peprilus paru*, crowded under the bell and among the tentacles of a sea nettle, I wondered which of the two was being preyed upon. Sometimes several fish, each about one and a half inches long, would swim in and out of a jellyfish with a boldness that was startling. I concluded that the close association was not mutually advantageous, for the harvestfish seemed to gorge themselves by a tearing action on the fragments of the tentacles and oral arms. The sea nettle, on the other hand, is not wholly unavenged, for every now and then it succeeds in stinging to death and devouring one of its persecutors.

In spite of its pestiferous nature, the sea nettle is one of the more extraordinary, if annoying, of the living things of the estuary. But, just as biologists believe they have overcome the sea lamprey problem in the Great Lakes region with a chemical that is specific only for the young stages of this parasitic fish-like animal, so they think the sea nettle can be controlled. In our present state of knowledge, we know of nothing that will kill jellyfishes and not also wipe out many other economically and ecologically important animals. Problems to be solved and obstacles to be hurdled are great for biologists who seek sea nettle control measures. Until the results of such work are in, it must be said that sea nettles are here to stay.

ACROSS MY LAWN

Dandelions grow across my lawn
Again in troops of little golden buttons;
Or, more than gold, they are plush the color of sunshine,
A lawn is a strange idea we have copied
From sheep-cropped pastures of old, and we must keep it
With our own clattering instruments. Beautiful?
Of course it is, but I shall not complain
That the sunshine has seen fit to crown my lawn
With flowers, after all—the only ones
That bow their yellow heads in quiet laughter
And live; with me and the mower all the reason
Striding past between them and the sun.

Allen E. Woodall

The Ugliest Bird on Earth

This young turkey vulture, clumsy and graceless on the ground, will one day become the epitome of aerial grace and floating beauty.

At nine weeks, the wing and tail feathers of the turkey vulture are well developed. The youngster pictured below quite obviously resents the cameraman's intrusion.

HALF A MILE from Portland Arch, in Indiana, the ancient Wabash River makes a sweeping turn around a thrusting finger of accumulated debris. A lightning-blasted sycamore tree towers sixty feet above the water there, white and scaly and dead. The limbs are naked of green, both summer and winter; but at night, all year around, they are burdened by a strange and heavy fruit.

This is a rookery; a home, of sorts, to some sixty or seventy of *Cathartes aura*, one of the American vultures that probably will never vanish into the limbo of extinction. In Indiana, as in many other places, this big bird is called the turkey buzzard, and, unfortunately, many of the older farmers along the Wabash mistakenly shoot it as a bird of prey.

We visited the rookery one fall night in the full of the harvest moon, and what we saw, heard and smelled was almost enough to end our bird-watching activities forever. We walked the two miles from our lodge, approaching the tree when it was silhouetted darkly against the newly risen moon.

Perhaps seventy feet away we stopped, with a primordial shudder running down our backs. It required but little imagination to conjure up all the loathsome evil that men for years have incarnated in the vulture. The stark white of the dead and riven tree seemed festered with restless, ugly lumps. From each lump arose, hung, or drooped naked, glistening heads, blue-white in the light of the moon, weird in their total effect.

The sight, in itself, was more than enough to fire the imagination; but there was the smell, and the sound, too. A vagrant breeze turned capriciously suddenly to endow the night with the odor of death and decay. We were enveloped in a fetid air of corruption that always arouses in man his deepest and most instinctive fears.

Coupled with the sight and smell, there came to our ears the clack of great chitinous beaks and the rustle of stiff, rigid feathers muffled to an undertone by the night and distance. Beneath this sound could be detected a soft, intermittent hissing and grunting, like a great valve gently loosing a bit of steam from the underworld.

We sat down quietly, and for an hour or so watched the birds from our post in the darkness. Some vultures slept with their ugly heads turned and tucked into a wing; others with their heads drawn down to rest loosely in the upper curve of the neck. Still others slept restlessly, moving uneasily and hissing irritably at a crowding neighbor. Just before we arose to go we

By

ROBERT B. McCOY

Photographs by W. Bryant Tyrrell

turned upon the birds a powerful beam of light from a lantern. There arose instantly a terrible outcry of loud, angry hisses and a bubbling of regurgitating grunts. None of the birds took flight, but many reared upward with outspread wings, bristling feathers and glaring eyes. It was like a scene from the *Inferno*, etched by Gustave Doré against a white and black night.

There are countless turkey buzzards to be seen across the United States south of the Canadian border, but they are more commonly known and seen in the southern States. Vultures of the family Cathartidae are known in temperate and tropical zones all around the world, but there are only two other species common to North America. There is the black vulture, *Coragyps atratus*, sometimes called a "carrion crow," which is well-known in the South Atlantic and Gulf States, and the California condor, *Gymnogyps californianus*, which is already far along the road to extinction.

Much more sinned against than sinning, the turkey buzzard is actually a mild and comparatively gentle bird, despite its yard-long body and two yards of wings. Its diet is exclusively carrion, and in these high speed days our highways provide a continuous banquet. Many States protect the bird legally for its expert scavenging service.

An adult turkey buzzard in good health may weigh up to twenty pounds. The feet and legs seem weak in proportion to its size, so that in feeding its movements appear to be ungainly and aimless. The wings hang carelessly, with the feathers loose. On the ground, the buzzard is incredibly clumsy, but in the air it is the epitome of grace and floating beauty. It may sail for hours, usually in circles, with never a flap of the wings. The late German naturalist, Friedrich von Humboldt, reported that the buzzard is the highest flying of all the birds, sometimes soaring to an altitude of 15,000 feet!

The turkey vulture is blackish-brown in color overall, with the wing coverts and linings a rather ashen gray. The naked head and neck of the male is probably responsible for the bird's singularly repulsive appearance. It is long—about 10 to 12 inches—and skinny, ranging from a vivid, heavily wrinkled red around the ears to a warty, scabrous parchment-brown sagging loosely to the point where the feathers start, just above the shoulders. The female's head and neck, colored about the same, is covered with a nimbus-like aura of furry-like down feathers. The beak in both sexes is strong and prominent, with the downward-curved and overshot upper mandible suggesting great tearing strength. The feet are yellowish, with sturdy but somewhat blunted talons. The tail is fanlike, apparently used mostly as a brake when alighting.

An invariable characteristic of the turkey buzzard in flight is its widespread primary wing feathers. When the bird is seen wheeling high in the sky, the end of each wing resembles a human hand with all the digits outspread. Some ornithologists think these widely separated primary feathers contribute greatly to the vulture's supreme ability to soar for hours on the air currents alone.

Turkey buzzards will nest in a tree, a low area of dense brush, and even, in some cases, on the ground. After the annual spring high water of the Wabash, we found a vulture's nest in the rotted stump of a sycamore about five miles north of the rookery. It was haphazardly built, with materials such as grass and leaves—brought from outside the swamp—surrounding the nest stump. No attempt was made, apparently, to weave

Little attention is paid by the hen vulture to the finer points of nest-making, the crude structure often consisting of nothing more than grass or leaves scratched into a rim around the eggs. Sometimes the nest is dispensed with altogether, and the eggs laid in the cavity of a log. The vulture chicks illustrated above, about three days old, were hatched in such a makeshift nest.

these into a nest; the hen seemed merely to have put the materials all in one place and then scratched everything into a sort of rim around a depression. The whole untidy structure was about the circumference of the tree stump, perhaps forty inches or so in diameter.

When we first located the nest the male buzzard was

nowhere to be seen, but the female cowered low until she knew she had been discovered. Whereupon she rose to full height, with wings half-distended and trembling. She clacked her beak with angry snaps, and hissed loudly. When we approached too closely—at about ten feet—she began hiccupping loudly, finally to disgorge a vile and loathesome product from her crop. The smell was so wretched that we retreated to a distance of about thirty feet. The female watched us intently, still snapping and hissing. After a while she clumsily took wing, flying in sudden and unexpected grace upward through the invisible aisles of the trees.

We held our noses to examine the two eggs, which were yellowish-white with many buff or brown mottlings around their larger ends. In size they resembled goose eggs, being oval in shape and about five inches from end to end.

On subsequent week-ends we visited the nest, always trying to take, on a long noose-stick, some gamey offering found along the highway. On our third visit we met the male for the first time. After conquering an inner feeling of revulsion, we came to see both the birds as interesting bird-people, and to some extent we even began to like them.

Over the weeks they grew to tolerate our presence at twenty-five feet or so, which was really as close as we cared to come, anyway. They carried on their domestic affairs without apparent fear of us, but they kept a constant and wary watch, nevertheless.

We do not know exactly when the eggs hatched, but it was evidently well within a five-week period. The parents did not leave completely whenever we were around after the chicks came, even when we drew to within ten feet. They put on a horrendous show, however. We feel sure there is no uglier sight in the entire bird world—and few more frightening—than an angry pair of brooding vultures.

The actual physical defense of these birds seems largely limited to vicious pecking and great, quick beats with the hard forewings. Their biggest defense in the face of danger is their ability to disgorge. Considering their diet, this is a peculiarly effective defense. Even the unprotected chicks are able to disgorge after the first week or so.

The male turkey buzzard is rather a devoted husband, apparently, and we saw no evidence in weeks of watching to suggest that either of the pair were unfaithful. Vultures are gregarious in flight, and sometimes in feeding, but we never saw another vulture come close to this particular nesting area. We do not know whether the same pair of birds use the same nest and site year after year. We had no way, of course, to mark either adult bird for later observation, but we think that if the same pair comes back again we will recognize the birds by their attitudes and gestures.

For instance, both the male and female of this pair eventually would watch closely while we gently extended the fifteen-foot, laden noose-pole to the base of their nest stump. Even as we withdrew the pole both birds descended to feed, paying no further attention to us. If we can do this again another year, it will not only suggest they are the same birds, but that they have a memory that lasts for at least a year.

The chicks were hatched late in May, being downy and probably blind at birth. Both parents fed the young at first, by regurgitation. At about three weeks, they were fed by tidbits torn from a larger piece carried in by beak. When last we saw the babies, at about three months, they still had the coarse, yellowish hair of babyhood overlying the dark first-feathers. They were not "problem children" in the nest, being quiet and still in the absence of the parents. At feeding time each struggled for first food, but after the parent selected the youngster to be fed, the other patiently awaited its turn.

We know of no natural enemy of the turkey buzzard. All of Nature seems to disregard these great birds completely. The adult buzzards live forever in a stench of death and decay, and the young acquire this dreadful smell with the first feeding. We handled the chicks—with gloves—at age three weeks, and even disposal of the gloves failed to rid us entirely of the miserable odor. Never again, we vowed, would we touch these creatures. And that feeling, no doubt, is shared warmly by all other creatures who know the buzzards.

Many farmers shoot vultures partly because of revulsion against their unwholesome appearance and habits, and partly because the bird's great size suggests that somehow it ought to be a bird of prey. Other than by decimation by uninformed gunners, and by whatever diseases vulture flesh may be heir to, the turkey buzzard proliferates throughout the whole range of its habitat without molestation.

UNWRITTEN MUSIC

The world abides in music:
Water, leaf, and bird
Distinctly heard
In harmonizing part.
The mind has orchestra
Conducted by the heart.

Gladys W. Ekeberg

Some ninety-five percent of the free world's supply of the strategic mineral boron comes from California's Mojave Desert. Illustrated is the open-pit mining operation of the United States Borax and Chemical Corporation at Boron, in a deposit that contains an estimated seventy percent of known boron resources.

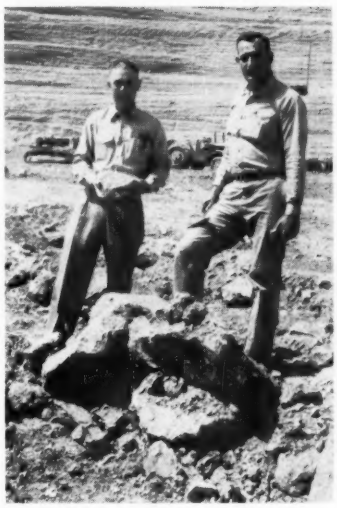
The Magic of Boron

By AUBREY B. HAINES

Photographs by courtesy of U. S. Borax and Chemical Corporation

YOU HAVE washed your hands and bathed your face thousands of times without realizing, perhaps, that you were using a key chemical of the jet age. This is the lightweight element known as boron, for years familiar in borax washing powders and boric acid solutions that have a mild germicidal action. A magic element, boron is a key ingredient in such diverse products as space ship fuels, atomic reactors, aviation gasoline, and heatproof plastics.

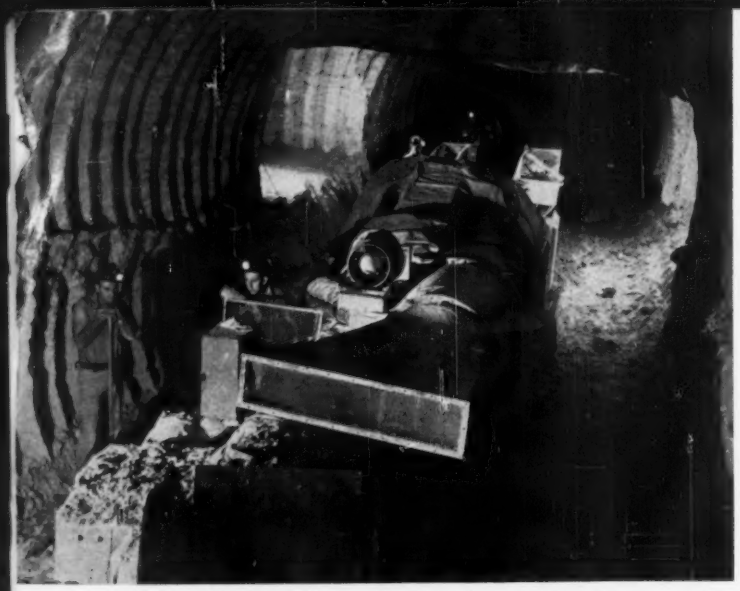
Boron compounds long ago stepped out of the kitchen, however, and became invaluable to industry. Actually, boron is "almost" a metal, although the appearance of borax minerals may be somewhat deceptive. It is technically known as a metalloid, with a melting point of about 2300 degrees Centigrade. However, when heated in the air, it is said to "sublime," or evaporate away, at a much lower temperature.



W. H. Wamsley, mine superintendent, and R. E. Kendall, assistant mine superintendent, stand beside the first exposure of borax ore uncovered in the open pit.

Strangely enough, ninety-five percent of the free world's boron supply comes from California, largely from underground deposits in the Mojave Desert. Already the element promises to unlock many a magic door of the future. Scientists claim that boron chemistry, now just beginning, will lead to hosts of new products to improve almost every realm of life.

Hence the remote reaches of the Mojave — explored and re-explored through the years by gold, silver, tungsten, and uranium prospectors— are being searched again. Great companies are leasing hundreds of acres of land on speculation, hoping that costly drilling will tap deeply buried deposits of boron ore on the shimmering floor of the Mojave's flat wastes. Surface deposits of worth were claimed years ago, and only by going under-



Before 1957 and the inauguration of open-pit mining operations at Boron, borax ore was mined by more conventional under-ground methods. Illustrated is a machine known as the "continuous miner"—one of the most efficient used in under-ground mining today—in the now-closed Jenifer Mine. The grooves in the walls and ceiling were made by the "continuous miner" as it ate into the borax ore.

ground, experts believe, can important new discoveries be made.

Nearly 150 feet under ground, the world's greatest single source of boron was found by chance. Just northeast of Edwards Air Force Base, this deposit contains an estimated seventy percent of our known resources. The town of Boron was named for this deposit when a driller, seeking irrigation water, noticed traces of a borate mineral. Later core drilling disclosed an ore body more than a mile long and from eighty to 250 feet thick. At the present rate of use, this ore body could supply borax for the free world's needs for the next century.

Because of increased demand this great ore mass is getting large-scale exploitation for the first time. The United States Borax and Chemical Corporation had been tapping the lode with mine shafts since 1927; but, in 1957, the company began open-pit operations.

Bulldozers stripped away 9,000,000 tons of dirt and gravel to expose glistening gray borate crystals. Today they are being extracted by fleets of steam shovels, bulldozers, and dump trucks at the rate of 800,000 tons annually. More than forty-seven percent of borax's weight consists of water, and driving off this water is the first step in processing borax to upgraded chemicals. Since it does not pay to ship water even for a short distance, the corporation built its new refining plant as close as possible to the edge of the open pit. Here the ore is dissolved and recrystallized for shipment to all parts of the world. The old refinery was located 140 miles away, at Wilmington, California.

Chemically, boron is the fifth lightest of the elements—a gray, extremely hard, nonmetallic substance first isolated in France in 1808. Found pure only as a laboratory curiosity, it is usually found in Nature as borax—sodium borate—a white salt with an alkaline taste. Through a great length of geologic time boron chemicals have accumulated in beds, some of them hundreds of feet thick, from Mono Lake to the Calico Mountains. Some geologists speculate that rain water has carried borax and other chemicals to the desert floor from surrounding mountains as they are slowly destroyed by erosion. Others, however, hold that these minerals have welled up from the earth's molten core.

But, if boron's past is conjectural, its future is hopeful. Researchers say that they are at the same stage in boron chemistry today that they were with carbon chemistry fifty years ago. A host of wonder fabrics emanated from carbon, including dyes, plastics, lubricants, and fuels. The same things and more come from boron, but in altered form. Some boron products have amazing lightness, some have almost diamond hardness, and others have great heat resistance.

Because of its lightness, boron is already a vital

The mule team pictured here carried a symbolic "last load" of borax out of the pit and through the plant on November 13, 1957, the day the U. S. Borax and Chemical Company dedicated its new installations at Boron.

ingredient in our "all out" research program for developing high energy liquid and solid fuels for jet airplanes and rockets. Already boron compounds send bombers faster, forty percent farther, and 30,000 feet higher than conventional fuels.

For some years past, the use of boron compounds has been common in cleansers, antiseptics, fertilizers, metallurgy, ceramics, and glass. Today, it is a gasoline additive whose makers claim that it improves engine performance. In solar batteries it helps to change sunshine into electricity. In atomic reactor shields a quarter-inch-thick layer of boron and plastic absorbs neutrons as effectively as eight feet of concrete. Sprayed into orange crates, a boron compound chemically seals bruised fruit, preventing its spoilage during shipping.

As a defoliant, boron chemicals strip leaves from cotton plants, enabling mechanical pickers to do a better job. Its compounds are attracted by cancers and, when bombarded with neutrons, yield bursts of energy that destroy malignant cells and leave healthy ones unharmed. It makes leather smooth and supple, and also retards burning when sprayed on forest fires. A vital trace element for plants, its presence in fertilizers also prevents celery stalks from cracking, apple cores from rotting, and alfalfa from yellowing. It hardens armor plate, and as an abrasive in the form of boron carbide it is almost as effective as diamond powder.

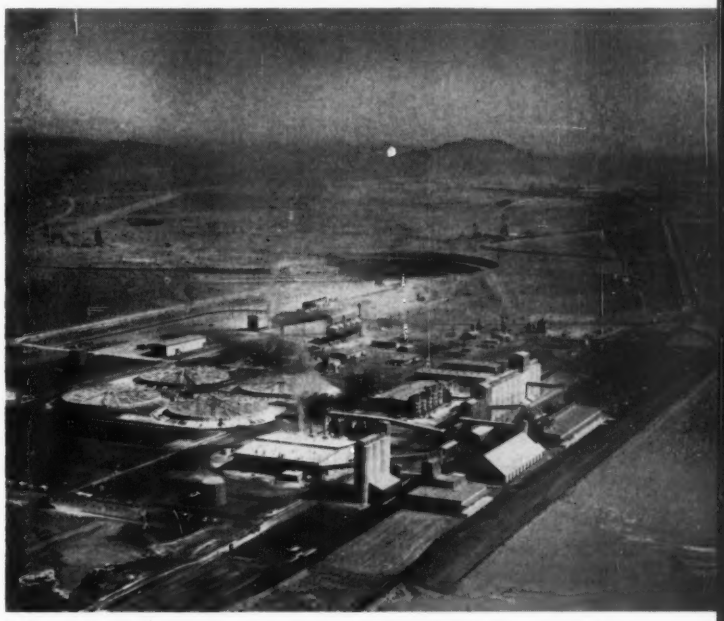
Some scientists believe that within ten to twenty years boron will be used mostly in plastics that are lighter than aluminum, stronger than steel, and as impervious to heat as fire-brick. But, although boron is much in the news today, it has been hunted and refined in California for more than a hundred years. Going back much farther, legend would indicate that man has used boron products for at least 4000 years. Ancient Babylonians are believed to have used boron as a flux or "gold glue," in working gold for rings, amulets, and breast-plates. The Egyptians may have used it to help mummify their dead.

Marco Polo brought the first borax to Europe in the thirteenth century from the court of Ghengis Khan, and the Chinese have used it as a glaze since at least 300 A.D. Until the eighteenth century, Tibet was the major source; then small supplies were discovered in Chile and in Italy.

The deposits that dwarfed all others, however, lay hidden in California until the year 1856, when Dr. John A. Veatch, explorer and mineralogist, detected borax in the waters of a mineral spring near Red Bluff. Although the discovery was not of commercial interest, months later Dr. Veatch found a deposit near Clear Lake. Although small, this deposit was worked, becoming America's first commercial source of borax.

The real borax rush began in 1872 with a strike by F. M. "Borax" Smith, at Teel's Marsh in Nevada, just across the State line from Mono Lake. There borax was found in the form of "cotton balls"—fluffy, crystal clusters. Not long after this a Death Valley prospector recognized similar crystal balls on the valley floor, and another rich strike was made.

William T. Coleman, a San Francisco financier, eventually took over the Death Valley claims and other desert deposits as far south as the Calico Mountains, establishing the Harmony Borax Works in Death Valley, the most remote commercial operation in the nation. But Death Valley was so hot in summer—reaching temperatures of 130 degrees or more—that workers had to leave for other deposits in the Amargosa Valley, where it was only 110 degrees! The remoteness of the borax workings led to the establishment of one of America's specialized transportation systems, the twenty-mule-team wagons. One hundred and sixty-five miles from Death Valley to the railroad at Mojave, the trip took ten days. The teams, hauling twenty-four tons of borax in two wagons, plus a tank wagon with 1200 gallons of water, stretched more than a hundred feet ahead of the driver. For ten years the route was used, and so soundly were the wagons constructed that those still extant are in excellent condition.



More than forty-seven percent of the weight of the mineral borax consists of water. Driving off this water is the first step in processing crude borax into chemicals; hence this new refining plant was built as close as possible to the open pit.

As production expanded, mines in and around Death Valley began "playing out," and a new source of borax was needed. By a stroke of luck, the huge deposit at what was to become the town of Boron was found by a driller seeking irrigation water, in 1925. Until 1957 the deposit was tapped solely by underground shafts, and the borax was shipped to a refinery at Wilmington,

California. Today, however, with the large open pit and adjoining refinery in full operation, the free world is assured of plenty of boron.

The only other substantial present-day production in California is from Searles Lake, near Trona, site of the greatest cache of diversified mineral wealth on earth. A catch basin for chemicals leached over the ages from the surrounding heavily mineralized Argus and Slate Mountains, the lake was discovered in the 1870's by John Searles. More than half of the ninety-six natural elements are found in this great treasurehouse.

Production costs of boron are secret but presumably high, although boron's advocates expect costs to drop within the next few years to permit extensive use of boron-chemical fuels. Officials look forward not only to extensive military use but to eventual civilian aviation consumption as well. Recently several oil companies announced the addition of boron to their gasolines to increase power. Boron also is used in making colored enamels and glazes for porcelain—in fact, boron is found today to have more than a hundred different industrial uses!

Salt and Summer

By GILEAN DOUGLAS

"...herring gulls, white against brown sand, drift across the spit..."

Illustration by Jane March

Part of the sky has drowned itself in the sea, and now the roof of the world is a paler echo of the ultramarine flooring. A spiderweb of cloud hangs suspended above Marina Island, where herring gulls, white against brown sand, drift across the spit or hold raucous conclave near the channel marker. The few taupe juveniles among them almost fade into the background of sunburned grass and faded evergreens. Sometimes the juveniles seem to be only a space in the white ranks.

But whiter still are the head and rump of the great bald eagle whose shadow is a cross of darkness moving silently across gray rock and cornflower sea. A lone harlequin flares up from quiet Indian Bay, and waves of the freshening wind chime on the beach. Beyond the light the burgeoning swells break more insistently into spray; quickening responses in the litany of white-topped mountains behind them.

Meadow cornflowers, daisies, mimulus, rabbitbrush, moonwort and twinflower mingle summer and autumn in one brilliant chorale of color. Ocean spray and foamflower repeat the water's ripples, fading gradually into the green silence of the woods beyond. Yet those woods are not entirely silent. The robin's robust chirp, the winter wren's light spray of song, the hermit thrush's swaying melody mingle with the forest stillness of late morning and leave it more complete.

What an exultant feeling wells up in me as I look at and listen to this beauty! Exultant just because I can see and hear, because I am alive in loveliness. How thankful I should be that through the checkered years I have kept joy in the good and natural things of earth. It is my thanksgiving; my praise to whatever Creator sowed such largesse of eternal thought in the garden of the world. Come sorrow, come pain, come death—it is worth them all and more, to have been able to feel right down to my very roots the splendor of this one day.

DESERT TORTOISE

Cautious, shy,
Plodding far,
Lumbering by
Is an armored car
Where a trackless road
Skirts the mesa shelf,
With its precious load
—Life itself.

Ethel Jacobson

During the past year two European nations—Rumania and Czechoslovakia—have issued sets of stamps illustrating common varieties of mushrooms, all of which are edible with the exception of the fly mushroom shown on Czechoslovakia's 1.40 koruna stamp below. Included on these philatelic items are the scientific names of the funguses, making the two series useful educationally as well as postally.

In Rumania and Czechoslovakia,

Mushrooms Carry the Mail

By BARBARA B. PAINE

HUNTING for edible wild mushrooms has always been a popular sport in the countries that now are behind the "iron curtain." When the Russians gave a splendid garden party for foreign diplomats, several years ago, one of the diversions offered the guests was a mushroom hunt. Lenin was an enthusiast and so, just to the west of what is now the "iron curtain," was Freud.

As further proof of European interest in mycology, both Rumania and Czechoslovakia have issued mushroom stamps during the past year. The stamps are especially interesting from the American point of view, because every mushroom depicted is more or less common not only throughout Europe but also in the United States. Compare these with your mushroom handbook.

The only poisonous mushroom of the group is Czechoslovakia's *Amanita muscaria*, shown on the 1.40 koruna stamp of that country, and nicknamed the "fly mushroom." In central Europe and the Baltic countries it has been used as a fly-killer for centuries. The balance of these philatelically honored funguses are high on the list of desirable mushrooms.

Three species are included in both series of stamps. Both open with the parasol mushroom, *Lepiota procera*—on the 5 bani and 30 heller—probably chosen for its large size and distinctive appearance as well as its excellent flavor.

The edible bolete, *Boletus edulis*, on the 1.75 lei and 40 heller stamps, is the famous French *cepe* and the German *steinpilz*, a mushroom of real distinction. Dried speci-

On Czechoslovakia's 40 heller stamp, second from left, below, is the famous edible bolete, imported specimens of which may sell for as much as ten dollars a pound in the United States.

Illustrated on Rumania's 2 lei postage stamp is *Cantharellus cibarius*, perhaps the best-loved mushroom of the philatelically honored group, and known in France as the "chantrelle."

mens from Italy sell for ten dollars a pound in New York City, where similar but less well-known species from Mexico and Chile cost only two dollars a pound. In the United States the edible bolete has a rather unusual distribution; it is common in mountainous areas from the Rockies westward, rare in the middle-West, and fairly common in the East.

The third species that appears on both series is the honey mushroom, *Armillaria mellea*, on the 35 bani and 1.60 koruna stamps. It grows throughout the United States, and, since it is a true parasite that attacks the roots of healthy trees and soon kills its host, is altogether too common. An Italian-American once told me that he gets up at five o'clock on Sunday mornings during the late summer and fall to gather this mushroom. If he slept any later than that, he said, rival pickers would be ahead of him.

Probably the best-loved mushroom of the group is *Cantharellus cibarius*, shown on the 2 lei stamp. It is the French *chantrelle*, the German *pfifferlinge*, and the "little fox" in Russia, to name only three of more than 200 terms for this fungus on the continent. In a good season several hundred tons are sold in Bavarian markets alone.

The ancient Romans were notoriously fond of mushrooms. Their favorite was Caesar's mushroom, *Amanita caesarea*, shown on the 20 bani stamp, freely eaten in Europe but gathered only by the most self-confident American mycophagists because it is easily confused with the fly mushroom. Another Roman favorite was the delicious lactarius, *Lactarius deliciosus*, on the 30 bani stamp, which was mentioned by Pliny and pictured on a fresco in the city of Herculaneum. The Russians are devoted to it, but the French feel that it is hardly worth eating. The reverse is true for the common meadow mushroom, *Psalliota campestris*, on the 1.55 lei stamp; it is rated highly in France—and in America, too—but is seldom picked in Russia because its flavor is thought to be inferior.

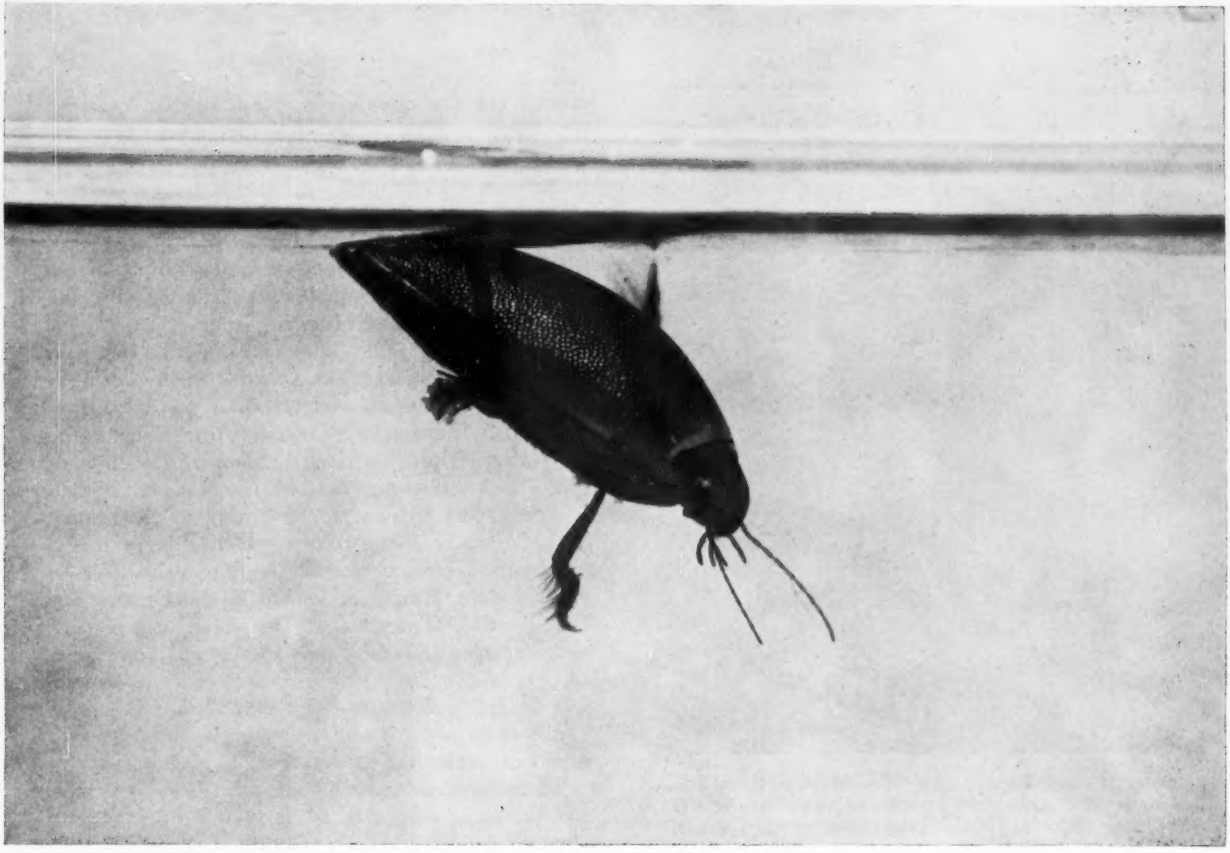
Mushrooms reflect many types of human prejudices. In India, for example, the Hindus may eat any kind of mushroom that has a pleasant taste and smell, but the Moslems may eat only the morel, *Morchella esculenta*—shown on Rumania's 1 lei stamp—all the others being regarded as unclean. The Moslems chose wisely from the point of view of flavor. When French mycophagists were polled, they voted for the morel as the most delectable of all, with the edible bolete and the meadow mushroom tying for second place.

A few years ago, R. Gordon and Valentina Wasson divided the world into *mycophiles* and *mycophobes;* those who appreciate wild mushrooms and those who fear them. The Slavs, the French, and the Italians are good mycophiles, while the English are mycophobic. Although active mycological clubs exist in Boston, San Francisco, Oregon, and elsewhere in the United States, on the whole this is a mycophobic country. But in the autumn, after a good rain, thousands of American mushroom hunters with mycophilic backgrounds scour the countryside for edible mushrooms. And about two-thirds of their choicest finds, both in quality and quantity, are pictured on the Rumanian and Czechoslovakian mushroom stamps.

THE BREAKFASTERS

Lone eagle on his early flight
And I walking under
Him are as different as night
And day, yet the wonder
Of it is this: together we
Drink from the morning cup
Of sky—he leaning over me,
I, reaching up.

Elaine V. Emans



Diving beetles, which often attain a length of an inch or more, are predators of the water world. Since these insects have no gills or similar body structures to absorb oxygen from water, they must back their hind ends to the surface of the water and poke the tips of their abdomens into the air, breathing through two spiracles, or pores.

Predators of the water world are the

Diving Beetles and Water Tigers

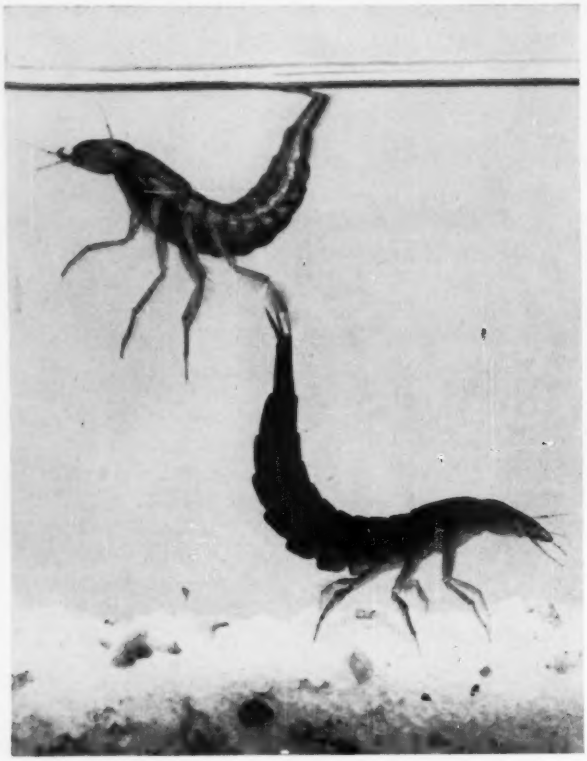
By HAROLD V. GREEN

BENEATH the surface of every pond, stream or roadside ditch is hidden a thronging, fascinating world. Some of the water-world creatures are so minute that a microscope is required to observe and to study them. On the other hand, there are scores of creatures that may be studied with the unaided eye. And, regardless of size, each is capable of providing hours of fascinating study, and even moments of thrilling adventure, for the surface of the water hides many exciting small-world dramas from those who indulge only in "long-distance seeing."

Diving beetles and their offspring, the so-called water tigers, among the many water-world creatures that I have studied and photographed, have drawn me to the ponds and ditches time and time again, for they are most active little predators and cannibals.

Diving beetles are, for the most part, relatively large aquatic coleopterans, often being an inch or more in length. They are somewhat oval in outline, and are usually dark and shiny. Although truly aquatic, they frequently take to flight in order to migrate from pond to pond. And, while on such migrant flights, they sometimes are attracted to street lights, where they often are noticed by people who do not realize that these insects are the same large beetles they have seen in ponds and ditches, hanging head downward from the surface.

These beetles have no gills or similar body structures to enable them to absorb oxygen from the water in which they live. When an air supply is needed, they back their hind ends to the surface of the water and poke the tips of their abdomens, which bear two large breathing pores (spiracles), through the surface film into the atmosphere. The insects also carry a secondary source of oxygen with



Water tigers are the larvae of predacious diving beetles. They stalk pond and stream bottoms or swim through the water, using their long, hair-fringed legs for propulsion. In this photograph, a water tiger is shown taking in an air supply through the tip of its abdomen, while the other water tiger is shown in typical walking pose.

Water tigers prey on many small aquatic animals, and even on each other. The cannibal in the photograph at the left is shown with two of its own kind lying dead and drained beneath its feet. Notice the two hair-fringed structures that anchor the tip of the abdomen to the water film.

them in the form of a large bubble of air that is trapped beneath their wing covers when they dive. They are, as might be expected, admirably equipped for aquatic locomotion. Their hind legs, which are the longest, are flat, oar-like limbs equipped with numerous long hairs that aid them in swimming.

Diving beetles are water-world predators, preying on other aquatic insects, snails, worms, leeches, tadpoles, salamanders, fish and even small frogs. Thus, in the matter of feeding habits, they are similar to the giant water bugs. Moreover, like the giant water bugs, they often are the cause of severe losses in fish hatcheries. In turn they are eaten by ducks, fishes, frogs, salamanders and turtles, despite the fact that they are able to emit, from glands behind the head and at the hind end of their bodies, a fluid thought to be distasteful to enemies.

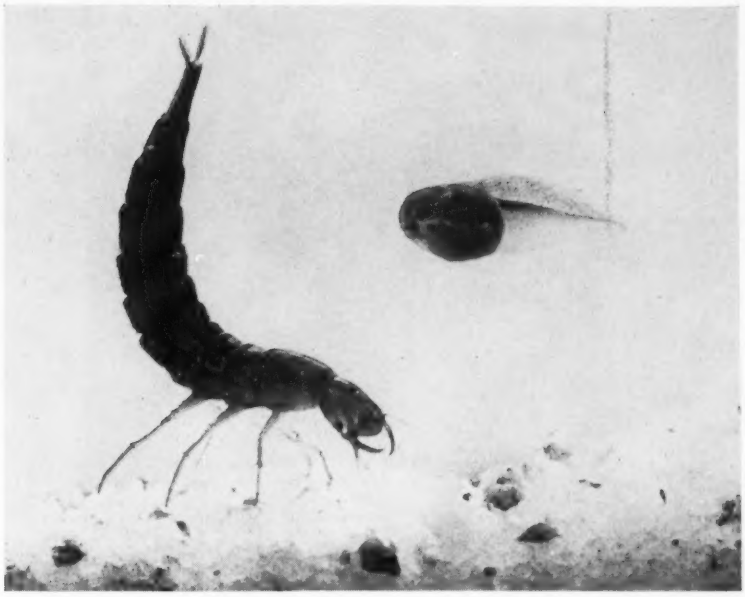
The young of diving beetles, which come from eggs laid by the adults and inserted singly into the tissues of various water plants, are known as water tigers, and little resemble their parents. They have long, curving, multi-segmented bodies, and their heads bear sharp, curved, caliper-like mandibles. They have two small, hair-fringed appendages that enable them to cling to the under side of the surface film when taking in a supply of air through the tips of their abdomens.

Water tigers are voracious little water-world predators and cannibals. They stalk along pond or ditch bottoms, or swim through the water using their rather long hair-fringed legs for propulsion, ever on the alert for prey.

In ponds and ditches, I have no doubt that water tigers kill only for food. In small aquaria, however, this is not always the case. Under such conditions I often have seen large water tigers nearly two inches in length pursue and kill tadpoles or other water tigers, one after the other, never pausing to take any nourishment from the victims.

Water tigers strike their prey with a rapid whip-like motion of their bodies, grasping their victims between sharp, caliper-shaped mandibles. They are drinkers, not eaters. That is, they possess no chewing or biting mouthparts and, therefore, must subsist on fluids. In order to gain more food value from their prey, they inject a digestive enzyme-like substance that liquifies flesh. They then suck away this nourishing fluid through grooves on the inner side of their mandibles.

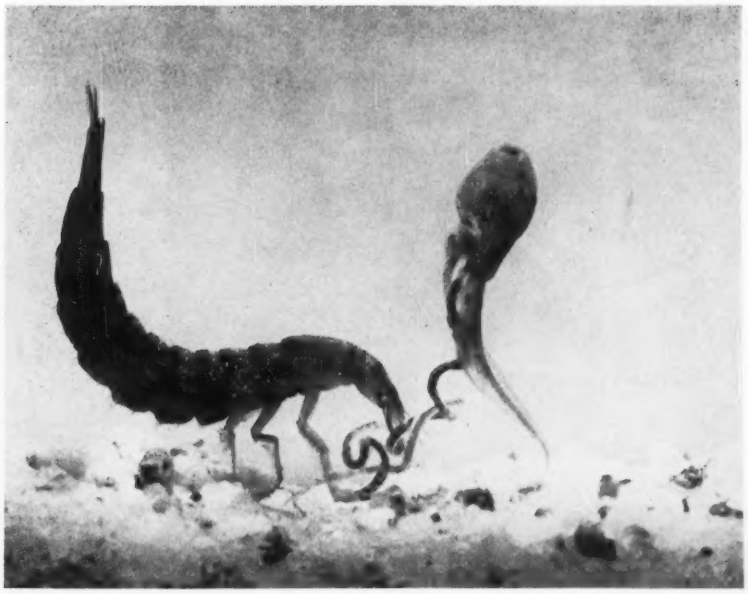
When full-grown, water tigers seek out the soil at the borders of their water-world, construct an earthen cell in which they pupate and, eventually, are reborn to swim once again the waters of our roadside ditches and ponds in a new and quite different form.



A plump tadpole swims toward a waiting water tiger, whose sharp, caliper-shaped mandibles are clearly shown. The tadpole's fate is illustrated in the photograph at the bottom of the page.

A water tiger is caught by the camera in the act of preying upon one of its own kind. Under normal conditions these insects are believed to kill only for food, but in small aquaria they have been observed to kill tadpoles or other water tigers without pausing to take nourishment from the victims.

Photographs by the Author



The tadpole shown at right, above, has been disemboweled by the force of the water tiger's blow. Soon the water tiger will insert its mandibles into the tadpole's body, inject an enzyme-like substance, and drain away the liquified flesh and the body fluids.

The nymphal shell of the dragonfly in the foreground has split, and the shiny thorax is visible. The second dragonfly has freed its head and legs from its old case.

Drama of the "Quick Change"

By MARIAN EDSALL

Photographs by the Author

The dragonfly's struggle to free its abdomen proceeds slowly by jerks, and by the steady pressure within the shell from the expanding body. The undeveloped wings are still in the shape of the small wing pads of the nymphal case.

Free of the nymphal case at last, the dragonfly crawls up and away from the case. Its wet wings are still formless and crumpled, but they will soon unfold to reveal a fully transformed dragonfly or "mosquito hawk."

The wings unfurl slowly in the warm air, still accordion-pleated at their bases.

As the wings lengthen and expand, the insect's abdomen becomes thinner and more elongate.

Pausing now for the wings to fully expand and harden, the newly-emerged adult will soon arise in full, swift flight.

In mid-July last summer, while we were camping on the shore of a western Ontario wilderness lake, our family had box seats at a transformation spectacle about which we had read but had never witnessed. During a forty-eight-hour period when the sun was warm and the breeze light, scores of dragonfly nymphs crawled up out of the water to the lichen-covered rocks to enact the annual drama that brings forth a graceful, soaring flyer from a rather grotesque water-bound crawler.

No creatures of the animal world put on such dramatic "quick change" acts as do some of our large and common insects; but commonplace as these occurrences are, we seldom witness them at close range. Indeed, we may even overlook many of the climactic activities in the small-scale world about us and underfoot, unaware that they are more intriguing than the most imaginative science fiction. The wonder is always new and interesting to children, and it was our sharp-eyed eleven-year-old daughter who excitedly called this drama to our attention.

I recorded the nymph-to-adult changes at ten-to fifteen-minute intervals during the hour or more that the transformation lasted. When we attempted to shift some of the emerging insects for better camera angles, we had abundant proof of their extreme vulnerability at this stage. To our disappointment, they "froze" upon being disturbed, and progressed no farther; the slight exterior pressures had disturbed the delicate and complex interior processes.

Dragonflies, often known as "mosquito hawks," are good neighbors for campers; as nymphs the insects feed voraciously on mosquito larvae, and as adults they prey on winged nuisances. We watched with gratitude as the young adults wheeled and swooped about our campsite at dusk on subsequent evenings, feeding on the hungry swarm that was headed, we could imagine, in our direction.

A typical Michigan Corrections Conservation Camp, built wholly by camp inmate labor to house 125 men. The camp has a recreation room, hobbycraft room, and many other facilities that are available to the inmates.

A Correction-Conservation Program

This buck, with a hunter's bullet in him, was brought to camp and nursed back to health by an inmate. The buck was then taken to a game refuge of the Upper Peninsula.

Each of the twelve Corrections Conservation Camps maintains a fire brigade, with modern equipment, ready to fight forest fire or lend a hand to nearby communities.

By JACK MOORE and C. MEACHAM

Photographs by Jack Moore

In the years that followed World War II, the State of Michigan was faced with a substantial increase in prison population. Adequate housing was not available, and although the State Corrections Commission during the war years had anticipated the coming shortage, there had not been sufficient time for the completion of additional housing. With rising population there also ensued an increasing lack of employment for inmates: for, even prior to the advent of the rising population, suitable jobs for the inmates were not available, and increased population merely aggravated that condition.

Meanwhile the Michigan Conservation Department was faced with the problem of developing its land and recreational properties with inadequate funds and labor. With more parcels of land coming under its jurisdiction, it wanted to develop these areas for the use of State citizens and tourists, but had been unable to make real progress because of budgetary and manpower handicaps.

As it happened, both Corrections and Conservation department officials simultaneously broached the subject of camps for prisoners, with conservation work as their assignments. This idea seemed to be a "natural," and the impetus that it needed was soon received. Through the enthusiasm and foresight of the new Commissioner of Corrections, Ernest Brooks, the Michigan Camp Program came into being.

Today there are twelve camps in the Camp Program,

located throughout the Lower and Upper Peninsulas of Michigan, with approximately 1200 inmates housed in clean, warm barracks. Not only does the Camp Program assist the Conservation Department in its activities, but it also lends it efforts to communities in projects relating to development. Among other activities, the Camp Program inmates have worked on the world-famous ski jump at Iron Mountain; assembled new ski tows at Porcupine Mountains; rebuilt the Boy Scout camp near Munising, and dismantled several buildings for colleges and institutes in Michigan.

Camp inmate work for the Conservation Department has included preservation of timberlands, fish hatchery work, road grading, policing of State parks and bathing beaches, picnic area construction, fire tower observation, deer refuge construction, and many other conservation-flavored activities.

Yet, with all this, the inmate enjoys many recreational activities, and there are Sunday church services in the inmate-constructed chapel on the grounds.

S. J. Gilman, assistant director of the Corrections Department, says: "The estimated 4.4 millions of acres in the vast State park and forest holdings of the Michigan Department of Conservation could absorb the work of 2000 inmates for twenty years, and there would still be much work for the Department to do."

This, then, is an outline of Michigan's Camp Program and what it is accomplishing. It is a far cry from the stones, the bricks, the steel, the clanging doors and the guns that are so frequently associated with a State prison!

The fawn at center was found with a broken leg by a Camp inmate in the Porcupine Mountains. Like the buck on the opposite page, it is now in a game refuge.

A pet of the 50 men in one Corrections Camp is this little nomad of the woods, a chipmunk that is fed and cared for like a baby.

Corrections Conservation Camp activities include the building of deer bridges. Many such bridges may be found deep in Michigan forests, timbers being hewed from the tall pines so symbolic of the State.

One job for the men of the Corrections Conservation Camps is to build roads for the State of Michigan. Here inmates are bulldozing their way through a heavily timbered area of the Upper Peninsula.

These are but a few examples of the familiar signs seen by thousands of visitors to the rolling hills, the woods and the streams of the many State parks scattered throughout the Upper and Lower Peninsulas of Michigan. These signs are made by the inmates of the Camp Program.

Among the varied assignments of the inmates of the Camp Program is the daily clean-up of the Michigan State parks. As many as 17,000 visitors make use of these recreation areas on a single week-end, posing a large task for the crews.

Another Park Invasion

Pere Marquette State Park of more than 5000 acres is the largest State Park in Illinois. It was acquired in the early 1930s to preserve an area of outstanding richness in its scenic, historic and natural history assets. Some twenty-five thousand dollars were raised by popular subscription, during depression times, to set aside this area for generations to come.

"This spot," says a folder issued by the Division of Parks and Memorials of the State of Illinois, "has been a central point for the natural attractions and much of the history of the midwest. The great beauty of well timbered bluffs and wide river valley is augmented with a wide variety of activities for the park visitor. There are many miles of foot trails, 14 miles of bridle paths and the park has its own riding stables, a Nature Museum from which start the hikes under trained naturalists, picnic areas with pure water and every other facility, shelters, refreshment stands, playgrounds and camping areas."

The folder describes the many species of birds and mammals to be found in the Park, and its notable geological significance. Historically the area is associated with early Indian tribes, with Father Jacques Marquette and Louis Joliet, and with other events in the rich history of the region. Several organized youth camps have been maintained within the Park, and attended through the years by thousands of young people who are now adults and voters.

The Park is located near Grafton, Illinois, north of St. Louis. From its bluffs, especially Quitt Point, highest spot in the reservation, can be seen the panorama of the flood plains of the Mississippi, Illinois and Missouri Rivers. The past tense would be better used here, for Quitt Point is now barred to visitors, as is, at least for the time being, a substantial part of the Park.

The reason? Construction *within* the Park of a Nike Hercules missile launching site at a cost "exceeding" 1,500,000 dollars, and incalculable other cost to the real owners of the area—the people of Illinois. Friends of the Pere Marquette Park are understandably up in arms at this invasion by the Department of Defense and the Corps of Engineers, whose refusal to recognize any other values than those which *they* see in an area is well known.

According to the Superintendent of the Division of Parks and Memorials of the Illinois Department of Conservation, the Army has only 26 acres under lease. He asserts that the remainder of the Park will be open to the public, that no physical properties will be damaged, and that, as a result of the construction, there will be an improved road to the upper Vacation Area. The superintendent adds: "We in the Division of Parks would have preferred to have the guided missile site outside the park, and we *suggested* this to representatives of the Army."

The italic is ours. Suggestion to the Army authorities is about as naive a way of protesting that we can imagine, as those of us who fought against the Army invasion of Wichita Mountains National Wildlife Refuge well know. The Army answered the gentle dissent of Illinois authority with the assertion that the chosen site was the best choice as part of the defense of the St. Louis area. And that, apparently, was that.

So far as we can discover this development came about very quietly, as is too often the case in affairs of this sort. Apparently no one in the Division of Parks was sufficiently dedicated to the protection of the areas entrusted to them to put up a real fight or to let the public in on the threat. Certainly the Army did not want to face the uproar that would have ensued had there been opportunity for public expression. So the bulldozers moved in, and by the time friends of the Park got wind of what was going on matters had progressed too far to stop.

Taking the Superintendent of the Division of Parks at his own word that only 26 acres have been leased to the Army, we wonder if he is naive enough to believe that this will be enough, later on. Or is he so innocent as to think that the devastation attendant on such an invasion would be confined to such a limited acreage? Indeed, some fifty acres on splendid Quitt Point have been sacrificed for a radar installation. About a mile away, approximately one hundred more acres in the most beautiful part of the Park have been devastated as the location of the launching site.

Quartering a hundred or so soldiers at the site is also a guarantee of future expansion—and future destruction. And, if we read the newspapers correctly, the Nike Hercules is now virtually obsolescent, and the Nike Zeus is now the pet missile. What this might mean to the Pere Marquette Park installation we do not know, but we would not regard the prospect with assurance.

It seems obvious that the integrity of another public reservation has been sacrificed to the facile and often specious plea of national defense. Another area has been damaged by refusal to consider other values of greater, if less spectacular, significance. Doubtless nothing can be done now completely to save Pere Marquette State Park for the people of Illinois and the nation. Rest assured that, as time passes, this invasion will not be contained within its present proposed compass. Such "toe-in-the-door" penetrations are never so contained. We can only hope that what has happened to this historic area will serve to remind us that constant vigilance is essential to the preservation of such reservations, set aside for a higher purpose and in the public interest.

Moose are mammals of the deep forests and bog lands, and prefer to lead a solitary life, except when individuals herd together during periods of deep snow. Mature bulls, with their heavy, flattened antlers, may weigh as much as 1500 pounds.

Moose calves are born during late May or early June, and are not spotted as are the fawns of deer.

Meet His Majesty the Moose

By BILL GEAGAN

"MA-WAH-UH, ma-waah-uh, ma-wa-aaa." That was the strange, lonely sound that rose and fell from a twenty-inch birch bark cone at my father's mouth. Wide-eyed, chilly, and a little frightened, an enthusiastic youngster was to learn, first hand, how hunters, using a "moose horn," called bull moose to their guns.

I was crouched in the bow of my father's eighteen-foot cedar and canvas canoe. It was midnight, and a late September moon, brassy and full-faced, bathed the lazy northern Maine bog stream and the great spruces that towered on its soggy shores.

September is the mating, or rutting season, as it is termed, and my father was imitating the call of a love-sick cow moose to attract any lonely bull that might be within hearing distance. Long periods of singing silence separated the calls through the moonlit morning. Too much calling would reveal the trap to any wise old bull, my father said.

Again and again he called, the long, white horn rising and falling in slow circles. A mocking echo that rolled and broke over bogs and ridges was the only reply.

My father listened hard, but not for the thunderous, forest-shaking roar known only to the fiction writer and those others, equally uninformed, who would have us believe that this magnificent animal is a dangerous, bloodthirsty "killer."

If a reply *did* come, it would be similar to that of the

cow, but much shorter and deeper. It might only be a series of guttural grunts. Often, however, the interested bull will make no reply at all, but will approach quietly and cautiously, my father explained.

The moon went down in the west, and finally a gray, frost-filled dawn was faintly breaking over the great wilderness. It seemed that my father's calling had failed. Then, suddenly, like the crack of a rifle shot, a tree limb snapped back in the black woods. A bull had heard the calls and was approaching slowly. Apparently he had traveled a considerable distance. Dipping the paddle quietly into the water, my father imitated the sounds of the cow walking in the shore shallows. There was silence once more. We waited, barely breathing. The bull was there. We were sure of that. But the bull was not sure, and he continued to wait.

The sound of cracking brush was nearer, now. Very near, and my father again picked up the horn, not to call, but to dip up water, and, holding the horn high, to pour it slowly back into the stream. His reason for this was obvious, even to me. This brought a deep, grunting sound from the forest. Then a dry alder stick was broken over my father's knee. That did it! It was the grand finale of the fake invitation to a tryst in the wilderness!

A moment later, the largest mammal I had ever seen outside a circus stepped majestically into the open. It was a huge bull, full of love, desire and tremendous power.

Below us, less than forty yards away, he sloshed into the water, looked hard and hurriedly about, grunted and walked back to the shore. I could see him plainly in the brightening dawn as he stood broadside, looking across the stream. The rawest novice could easily have felled him with a gun.

My father took careful aim behind the huge fore shoulder, shouted "bang," and lowered the paddle. "Sorry, old boy," my father shouted with a laugh as the moose, his disappointment exceeded only by his surprise, was away with a rush into the still, dark woods.

That interesting and exciting experience was planned by my father to introduce me to the ways of the moose and reveal to me the absence of "sport" and "danger" in the gunners' slaughter of these magnificent animals.

For those without first-hand knowledge of the moose, this mammal is about the size of a small horse, and is brownish-black and hump-shouldered, with long legs and large ears. The mature bulls, often weighing up to 1500 pounds or more, carry heavy, flat antlers rimmed with irregular points. These, like the deer's, are shed in the early winter and are replaced by new antlers in the spring. Unlike the deer, the moose does not bound gracefully and swiftly away from danger, but turns in a rather deliberate manner and trots into the woods.

Moose are mammals of the deep forests and bog lands, and most of their lives are spent in such wilderness environment. During the summer they may be found along waterways, where they rid themselves of annoying insects and feed in a leisurely manner on tender, aquatic plants.

Moose prefer a solitary life except when herded together during periods of deep snow. Unlike deer, which herd in frozen swamps and feed on cedar browse during severe winters, moose prefer the flanks of hardwood ridges, where they browse on buds and tender twigs. The year-around diet, however, varies but little from that of the deer, and includes shrubby vegetation, sprouts of red maple, willow, aspen, balsam fir, the striped maple—often called moosewood, or moose-maple—and occasionally bark, especially that of the aspen. They also eat some mosses and lichens and, during the summer, the water plants of pond and stream shores.

The mating, or rutting, season begins in early September and continues for four or five weeks. One or two

Sometimes a lonely bull moose seeks the company of domestic cows; the bull moose in the photograph at right refused to leave this Maine cow pasture and had to be returned to his wilderness home by game wardens.

A mysterious disease is taking a toll among the moose population. The old cow shown below is one of the many moose that are treated at the University of Maine.

calves are born during late May or early June, after an eight-month gestation period. Moose calves are not spotted as are the fawns of deer.

The relentless march of civilization and a great and wasteful slaughter by meat and hide hunters and "sportsmen" has exterminated the moose over much of its natural range in the United States. That original range included what are now the States of Pennsylvania, New York, Connecticut, Massachusetts, Vermont, New Hampshire, Maine, Michigan, Wisconsin, Minnesota, North Dakota, Wyoming, Colorado, Montana, Idaho, Oregon, and Washington.

The moose now is found only in western Wyoming, eastern and northern Idaho, western Montana, and occasionally in northeastern Utah, northern Michigan, Minnesota, now and then in New Hampshire and Vermont, and in many parts of Maine, in which latter State there are an estimated four to six thousand of the great mammals.

In Alaska, the moose is found in the heavily forested areas, and in such Canadian areas as western Ontario, the western Yukon country, central British Columbia, the Mackenzie Delta and Northwest Territories, New Brunswick, Nova Scotia, Quebec, Manitoba, Alberta, Saskatchewan, and Newfoundland, where it has been introduced. Hunting of the moose now is legal only in a few parts of its remaining range, and, in most of them, only for brief periods each year.

According to the U. S. Fish and Wildlife Service, the moose is dwindling in numbers over its original range, but in some areas it seems to be increasing somewhat. The early destruction of the moose in Maine is probably a typical example of what happened to this mammal in many parts of its original range.

A great many moose roamed the forests of Maine up to the year 1830. Until that time there was neither a closed season nor a bag limit. The moose could be killed in any numbers and in any manner, and many meat, hide and head hunters took full advantage of such a situation. The meat was served in lumbering operations and commercial and private camps, much of it being left in the woods to feed furred and feathered scavengers. Commercial hunters enjoyed a bonanza, shipping the hides and the whole carcasses to city markets in Maine and other States.

The first bit of protection for the moose came in 1830, when hunting was confined to four months, September through December. But still there was no bag limit on either sex, or even on little calves, and enforcement was pitifully weak.

The movement toward protection continued until 1840, when, because of political pressure, ignorance, or a combination of both, the State lawmakers increased the open period to include all months except July, August, September and October. The law was changed many times after that, but almost always in favor of the hunter rather than the vanishing moose.

It was not until 1889 that a bag limit of one bull became law, and cow moose were protected at all times. But inadequate enforcement of the law made it possible for heavy slaughter to continue in many sections. Then, finally, when it was plainly evident that the moose was headed for extermination in Maine, moose hunting was banned entirely for a few years prior to 1927. Half of the sixteen counties then were reopened to the "sport" for one week only. A ninth county was added to the list in 1929.

Shortly after that, the Fish and Game Department rolled its sleeves high and brought about a temporary end to moose hunting. But in 1935, after repeated complaints by farm owners and others whose property was being damaged by moose in three coastal counties, a special three-day season was declared for the month of November.

Moose sometimes visit cities and villages, become confused, and must be assisted in returning to their natural habitat. In this photograph, an old, antlerless bull moose is heading for the business section of Augusta, Maine.

A horde of gunners from all over the East then swarmed into the woods of those counties, doing more damage than the moose. The total kill included a few bull moose, as well as cow moose and some pastured domestic stock. That experience ended all moose hunting in Maine—for all time, it may be hoped.

Taking a wildlife census in deep woods is a difficult task, but biologists and wardens of the Maine Fish and Game Department, after repeatedly checking winter yarding places in planes and on foot, report the mammals on the increase. This increase continues despite the toll taken by accidents, poaching, and a mysterious disease that is being studied in both live and dead

A wildlife agent of the Alaska Game Commission spotted these two fighting bull moose from an airplane in December, 1939, at Farewell Lake, Rainy Pass, Alaska. Upon landing, the agent approached the bulls with two aides, sawed the antlers, and freed the moose. One of the mammals died of wounds received in the fight, while the other, after attempting to attack the rescue party, returned to the woods.

Fierce locked-antler battles take place between bull moose during the mating season, but rare are the human witnesses to such struggles. This pair of entwined antlers attests the death of both bulls.

moose by pathologists at the University of Maine.

This strange and always-fatal malady is most common during February, March and April. Sick moose show little fear of man, often seek open places, seem drowsy, and usually carry the head tilted. They eat little or not at all. Many are heavily infested with ticks. Ultimate death results from several complications, including pneumonia.

Perfectly healthy moose sometimes wander into the residential and even the business sections of some Maine cities and villages. Others are chased into town by farm dogs. The moose are extremely curious and do considerable nosing around while frightened pedestrians flee and put in hurried calls to the nearest game warden—or even to Fish and Game Department headquarters in Augusta. But the strange visitors from the woods much prefer the solitude of their wooded haunts, and do their best to find their way back to their natural home. Badly confused animals often are assisted in their return to the wild by the game wardens.

Occasionally a lonely bull moose will put in an appearance at a farm and seek the company of pastured domestic cows. Some years ago a farmer in the western part of the State complained to the Maine Fish and Game Department that a big bull had been molesting his cows for more than a week. And, as it was September and the mating season, the farmer feared that the antlered monarch might mate with the cows and leave him with a lot of worthless freaks on his hands!

The big moose had become quite tame by this time, and he allowed several wardens and their helpers to get close enough to throw a lasso over his massive, antlered head. Those on the end of that long rope were given a merry ride around the pasture on their shirt-fronts and trouser-seats before the mammal's legs finally were caught in another noose. Roped and eased up a plank ramp into a big van by a large crew of men, the moose was hauled back to the "big woods" far from the farm and carefully released, none the worse for his experience.

Moose, like other wild animals, may become belligerent during the mating season, especially if they have been injured. Imitating the call of a moose cow late one September afternoon—to test my prowess with the birch horn—I was chased and forced into a tree by a large bull. Thinking that my calling had failed, I had come out of the bog and had started back to camp. Apparently the moose had heard me and had quietly come to the call, but had found no mate. Seeing me, he had followed slowly behind. I heard a twig snap, turned, and there was Mr. Moose less than thirty feet away!

When I walked slowly, the moose walked slowly. When I ran, he, too, increased his speed. But there was no roaring, head-down charge. (*Continued on page* 332)

Environment in Evolution

By EDITH S. CLEMENTS

Photographs by the Author

In 1876, Charles Darwin wrote to Wagner, the advocate of origin by isolation, that "in my opinion, the greatest error that I have committed has been not allowing sufficient weight to the direct action of the environment, i.e., food, climate, etc., independent of natural selection."

"When I wrote the 'Origin' and for some years afterwards," said Darwin, "I could find little good evidence of the direct action of the environment; now there is a large body of evidence." It would seem to follow, from these remarks, that the critics who have attacked the major conclusion of the famous *Origin of Species* have not been aware that they were trying to demolish a view that Darwin, himself, had begun to doubt!

That "large body of evidence" has been further increased by some forty years of experiments in environmental evolution at the Alpine Laboratory on Pike's Peak in Colorado and at the Coastal Laboratory at Santa Barbara, California, by the author and her husband between the years 1900 and 1940.

As early as 1635, Bacon had suggested that marsh herbs be planted on the tops of hills and dry plants in wet places. But it was not until two centuries later that actual transplants from one environment to another were made by Naegeli, when he brought alpine plants down to the Botanic Garden at Munich, Bavaria. Since the results of the experiment were disappointing, Naegeli went no farther. The earliest successful attempt to use this method of experimentation was by Bonnier, first in 1884 but mainly during the years from 1887 to 1889. Bonnier realized the importance of using divisions of an individual plant and utilizing the same soil in order to avoid local effects. The accuracy of his results has been confirmed by later experiments, as well as his conclusion that plants transferred to alpine stations become identical with native forms that are often treated as valid species themselves.

These earlier studies were a stimulus to the "Clements team" of young ecologists who, in 1900, had discovered an ideal place for experimenting with the effects of different environments on plants when they spent a pleasant summer vacation in a rustic cabin on the slope of Pike's Peak at an elevation of 8000 feet.

Conditions at this cabin were ideal for studying plant adaptation and evolution, since in a distance of only seven miles—from the plains below at 6000 feet to the alpine tundra at 12,000 feet—there was a range of climate equal to a move from the temperate to the arctic zone. At 8000 feet there were slopes clothed with spruce and pine, offering all degrees of shade, with trails and sunny openings, while the banks of two mountain streams offered variations of soil moisture in both sun and shade. Sunny gravel slopes along the cog railway provided locations of warmth and dryness, and the convenience of trains for carrying plants through a wide range of altitude made the opportunity for studying environmental effects almost limitless.

First, of course, the team needed a knowledge of the plants of the region. This was gained by collecting plants within a radius of nine miles from the mid-alpine center—not only typical specimens of each species, but also their various forms as modified by different locations. For example, the black-

Between the years 1900 and 1940, the author and her husband conducted experiments in environmental evolution at the Alpine Laboratory on Pike's Peak, Colorado (photograph at the left) and the Coastal Laboratory at Santa Barbara, California.

eyed susan, *Rudbeckia hirta*, was represented by seven different habitat variations, and all species by at least some variations. The work of digging, pressing and drying several hundred species and their modifications was shared by friends and relatives of the Clements team, with the chance to spend summers in an enjoyable locality as a reward.

During later summers, groups of students from the University of Nebraska occupied the larger cabin at the same location, doing the work of installing experimental gardens in differing conditions of sun, shade and moisture, and studying ecology under Dr. Clements. By 1918 the Carnegie Institution of Washington, D. C., had become interested in establishing an alpine laboratory fully equipped for extended research into the role of environment in modifying species. Summer cabins and land were bought, and money was made available for instruments, stipends for summer assistants, and a permanent staff.

The illustration at the left shows the sun (at left) and the shade (at right) reciprocals of the false Solomon's-seal. Plant at right grew in shade at 6000 feet. The illustration at right shows the effect of transplanting from higher to lower altitudes. The arctic fleabane, *Erigeron uniflorus*, at left in this photograph, is a native alpine dwarf. The plant on the right is an adaptation to montane shade at an elevation of 8000 feet.

From that time on, expansion was rapid, and the Alpine Laboratory became known the world over as a center for ecological research, visited by both American and foreign scientists. Many of the results attained here were published from time to time, and after 1920 were supplemented by similar experiments at a coastal laboratory in Santa Barbara, California, where work could go on during the winter months. The complete account of the methods and results obtained at both these centers has been published by the Carnegie Institution, and only a few of the outstanding successes at the Alpine Laboratory can be mentioned in this article.

The final installation consisted of three altitude stations—a plains station at 6000 feet in the suburbs of Colorado Springs, a mid-alpine station at 8000 feet, and an alpine station at 12,000 feet. Each station was equipped with instruments for measuring all the factors concerned in plant growth. Hundreds of species — many of them from foreign countries—and thousands of individual plants were the subjects of observation and experiment under varying conditions at each station, and were transplanted from one station to another. The cog railway trains running between Manitou and the summit of the mountain proved a great convenience in the study of altitude effects on plants.

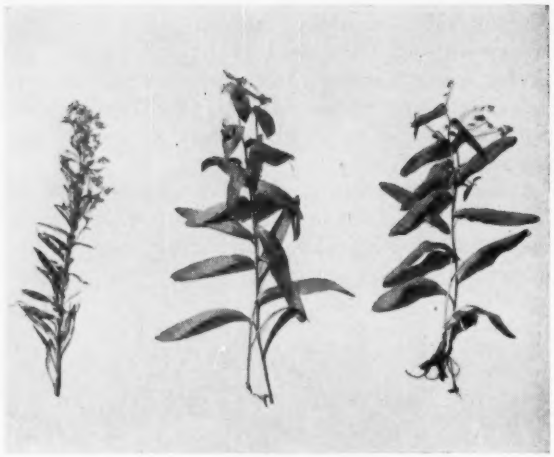
It should be remembered that the term "species" as we are using it here, refers to the original identifications made by Linnaeus and the early conservative taxonomists, and not to those of the later so-called "splitters," who worked with dried specimens and were likely to magnify small differences into specific distinctions.

For example, Linné divided the genus *Mertensia* into five species, but in Rydberg's manual there are forty-eight species of *Mertensia* and in Nelson's there are fourteen species with sixteen varieties. Many of these may be found in Nature merely as habitat forms, and can be changed from one to the other by changing their environments!

The sun form of false Solomon's-seal, for instance, is described as having glaucous leaves that are folded longitudinally to make a sharp angle with the stem. In the shade form the leaves are horizontally spreading and are not silvery. These characteristics have been used in taxonomic keys for the separation of supposedly distinct species. When plants of the sun form were grown in moist, shady places for a single season, the leaves became identical with those of the shade form. On the other hand, when transplants were taken from the shade and placed in sunny, open places the leaves became glaucous, tended to fold longitudinally, and assumed an ascending position. These results have been checked by removing the leafy canopy above plants in the shade without moving the rootstocks; the change to the sun form became complete, and two supposedly different species were growing from the same under-ground parts!

Other striking modifications followed the removal of the forest canopy by fire. For example, the smooth fleabane, *Erigeron glabellus*—a shade species of *Erigeron*—not only changed in a relatively short time to resemble *E. macranthus*, the sun form growing nearby, but eight years later the plants of the smooth fleabane that had been placed in the sun garden appeared completely

Shown in the photograph above are seven habit forms of the black-eyed susan, *Rudbeckia hirta*, at the Montane Station's elevation of eight thousand feet. From left to right, the plants are those of dry shade, moist shade and lath-house shade; sun-wet, sun-moist, and sun-dry locations; and, at the extreme right in the photograph, a competition dwarf.



Sun and shade conversions of *Mertensia* (bluebells) are shown above. In the illustrated case, the lance-leaf bluebells has been converted to the Franciscan bluebells by shade. The plant at the left is a normal lance-leaf bluebells in the sun; center, a conversion form in lath-house shade; right, a normal Franciscan bluebells plant, *M. pratensis*, in shade.

The two plants at the left are habit forms of the rose-root sedum, *Sedum roseum*, at an altitude of 12,000 feet. The plant on the left was in a sun-moist condition, that on the right sun-dry.

identical with *E. macranthus*, the aspen fleabane. In the same way, other species normally growing in the shade of the forest were changed when exposed to sunlight, after the fire, into forms commonly regarded as separate species. In some cases, new and characteristic sun forms were developed.

One of the most noteworthy conversions occurred with closely related species of Virginia bluebells when the shade-lover, *Mertensia pratensis*, was changed into a form resembling *M. lanceolata* after living in the sun, and actual conversion was achieved later when the species was transplanted in the alpine garden. After four years of exposure to a light intensity of twelve percent in the lath-house at 8000 feet, all the individuals of *M. lanceolata*, the lance-leaf bluebells, have been converted into plants that could not be distinguished morphologically from the controls of *M. pratensis*, the Franciscan bluebells. Transplanting these two species from 8000 to 12,000 feet altitude resulted in the conversion of the lance-leaf bluebells to the Franciscan bluebells, in the lath-house, and the conversion of the latter to the former in the alpine sun garden!

Success also had attended the reciprocal exchange of habitats for species that grow in different degrees of soil-moisture, and a study of the changes brought about by altitude has added much to our knowledge. Bonnier had made no attempt to measure the environmental factors involved in the transfer of alpine and lowland plants. He concluded that the structural changes that occurred were primarily due to greater light intensity, aided by drier air and lower temperatures.

However, similar experiments at the Alpine Laboratory showed that the intensity of the light was not responsible for the dwarfing of alpine species, but that the water content of the soil was the controlling factor in many cases. A number of species appeared dwarfed in soil with a low percentage of available water, but grew normally tall in higher amounts although the light intensity remained the same. Moreover, when accurate determinations were made of the light intensity at different altitudes, it was found that there was no appreciable difference from 6000 to 12,000 feet.

Temperatures were found to be ten degrees less at 8000 feet than at 6000 feet, and fifteen to seventeen degrees less at 12,000 feet than at 8000 feet. Differences in the length of season also were noteworthy. Plants were able to grow for four and a half to five months during the summer at 6000 feet, for three and a half to four months at 8000 feet, and for scarcely more than two and a half to three months at 12,000 feet. This is a difference of some two and a half months between the plains station and the alpine gardens. (*Continued on page 330*)

A New Jersey farmer rotates

Potatoes, Geese and Ducks

By R. FRANKLIN DUGAN

Russell Petty, conservation-minded potato farmer of Cranbury, New Jersey, is shown with his Irish water spaniel, "Shane O'Shaughnessy."

Russell S. Petty, a Cranbury, New Jersey, potato farmer, has found that farm ponds, besides being good for irrigation, make a wonderful home for a variety of wildlife.

Mr. Petty has been cooperating with the Freehold Soil Conservation District, in his own words, "as long as I've been farming, I guess." His agreement dates back to 1947.

When Petty moved to the farm where he now lives, he was discouraged by the dwindling wildlife of that area. Once an enthusiastic hunter himself, he had kept many hounds and bird dogs, but he had practically given up this "sport." He enjoyed having animals around alive, so that he could observe their activities throughout the year, and he decided to try to establish a wildlife population of his own. He wanted animals that would live on his farm, and increase its value. Both he and his family wanted not just a place to live, but a home they could enjoy.

In 1948, Mr. Petty used a bulldozer to scoop out and dam up a section of the small stream running through his farm, and this created a pond a little more than an acre in size. The deepest end held about fifteen feet of water. Originally the pond was fed by the stream, which came from a swamp, and the water was rather acid and quite dark in color. To improve the chemical quality of the water, Petty built a by-pass for the stream. Now the pond is fed by run-off and seepage from the area around it.

Mr. Petty purchased eight young Canada geese and a few mallard ducks from a Pennsylvania game farm and kept the young honkers penned near the pond for a few

The oldest of Russell Petty's three ponds furnishes abundant irrigation water, and serves as a year-around home for a variety of ducks and geese, including the "Canada honkers" shown in the photograph.

PHOTOGRAPHS COURTESY U.S. SOIL CONSERVATION SERVICE

Wood ducks make their homes in the flooded trees of the background, while overhead can be seen some of the Canada geese that live on Mr. Petty's ponds.

weeks. Then he released them, but continued to feed them on the pond banks. The birds responded by adopting the pond as their home, so Petty posted his farm as a wildlife sanctuary. That fall, flocks of wild geese flew overhead on their way to southern winter "resorts," but Petty's flock refused to be lured away from its comfortable living quarters. His birds wintered there.

The next spring the geese paired off, and proceeded to raise native New Jersey goslings. They have been joined by other wild geese in succeeding years, and each summer brings a new crop of downy goslings. Petty has seen more than 200 geese at one time on his ponds, and the ducks also have multiplied.

Potato growers in New Jersey must have enough water at the right time, or their crop is a failure. So, as Petty increased his acreage of potatoes, he felt the need of an irrigation system. With the help of the Soil Conservation Service, he built two more ponds. One is mainly a deepened section of the stream below the first pond, while the other is above the original pond, and was made by damming the stream to flood the swampy area. This series of ponds gives him—and his feathered friends—a total of about eight acres of water surface.

Petty operates two farms. He and his family live on the one with the ponds, while the other, nearby, is occupied by his father. Potatoes are grown in alternate years on the two farms. Thus, each year one farm is in soil-conserving cover crops, building up fertility for the next year's potato crop. In this way, the ponds are used for irrigation only every other year, but they continue to yield a bountiful harvest of wildlife *every* year.

The first use of the ponds for irrigation was during the summer of 1957. Because of the severe drought that year, Petty was forced to draw water from all three ponds. "By the end of the summer," he says, "I didn't have any water left in either the upper or lower pond. And the old pond was down to less than half its usual area." However, the waterfowl did not lose hope. They stuck with the ponds, and finally the fall rains rewarded their patience.

Although the eight geese and a few mallard ducks were all that Petty purchased, it was not long before his ponds were filled with other water-loving birds, ducks being the most numerous. Mr. Petty says, "I guess I've seen about 3000 ducks at one time, on the ponds and the shore." The most common species are mallards and blacks, both of which nest on the farm. Several other kinds visit, however, including teal, pintails, and canvasbacks. There is a small area of woodland above the oldest pond, and since the upper pond was built, most of this woods is flooded. The trees have been used as nesting sites by those famous specialists in color, the wood ducks.

Shore birds and herons are usually present, too. In the fall of 1958 Petty was surprised to discover an osprey stopping for a few days on its way south. Muskrats, of course, make their homes in the pond banks. Other wildlife such as raccoons and deer use the ponds for drinking water. No gunner ever receives permission to kill even one bird on Petty's property. At first, the local hunters resented this, but in recent years their attitude has changed. They now recognize the value of the breeding stock that Petty protects.

Petty's rotation of potatoes and geese may be unique. But his use of conservation practices to secure a better living and a better way of life is typical of thousands of conservation farmers. Anyone who talks with him for a few minutes is soon convinced that Mr. Petty is thoroughly "sold" on conservation practices. As he puts it, "I wouldn't trade my eight acres of ducks and geese for eighty acres of potatoes!"

FLIGHT

By Elizabeth Phillips Jones

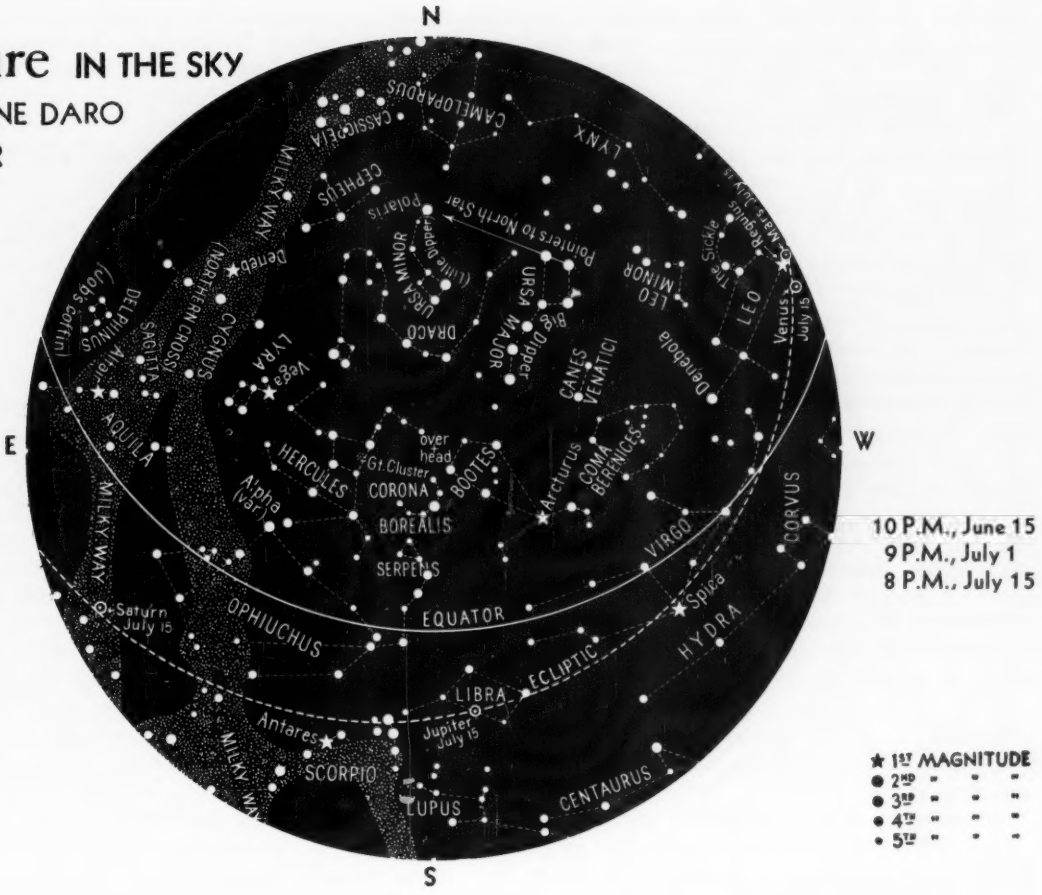
The day was right
The timing suited
To fledglings' wings.

To watch the uncertain flutter,
The velvet stir,
The hesitant clinging
To the nest,
And then the sudden whir,
Seemed too much
Of intimate things
For mortal eye to share.
And, that I
Should be there

To see the empty nest,
And in the distance
Hear the whir of fledgling wings.

Nature IN THE SKY

By SIMONE DARO GOSSNER



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. Times given are for Local Standard Time.

The Phases of Venus

THE PHASES of the moon are a phenomenon familiar to everyone. The moon goes around the earth once every twenty-nine and one-half days. In the course of this lunar month, there comes a time when the sun and the moon are to be found in the same part of the sky. At that time, we are looking at the side of the moon that is turned away from the sun; that is, the dark side. In other words, we can not see it at all, because it is not illuminated. This is the New Moon. About fourteen days later, the sun and the moon are on opposite sides of the earth. We thus are looking at the side of the moon that is turned toward the sun—the bright side—and we say that the moon is full.

Between these two extreme phases we witness all the intermediate ones, from a thin crescent through the quarter phases (first or last) to the gibbous appearance that the moon takes when it is almost full. It is quite evident that if the moon were to stay always on the side of the earth opposite the sun, it would remain full at all times.

When we look at Venus with the naked eye, we are totally unaware of the fact that it, too, shows phases. We fail to notice them because Venus is much farther away than the moon, and appears merely as a bright spot of light in the sky. When viewed with a telescope, however, the phases of Venus readily become apparent.

The phenomenon involved is slightly more complex than in the case of the moon. First of all, Venus does not revolve around the earth, but around the sun, taking 225 days to do so. But, because the earth moves during

that time interval, it takes Venus 584 days to return to the same relative position with respect to the earth and sun; that is, to be viewed from the earth under the same kind of illumination.

The deciding factor in the matter of the phases of Venus is the fact that this planet is closer to the sun than we are. Its mean distance to the sun is sixty-seven million miles, as against almost ninety-three million miles for the distance sun-earth. Therefore, we never see Venus fully illuminated.

As an illustration, let us follow the planet through an entire period of 584 days. This is known as the synodic period. At inferior conjunction, the planet is located between the earth and the sun. Its dark side is turned toward us, and we could not see it even if it were not lost in the sun's glare. We could say that Venus is "new," although this expression is not in common use. Then the planet moves gradually west of the sun. Its appearance is now that of a thin crescent, which increases gradually until the greatest western angular distance is reached. This is called the greatest western elongation. At this point, Venus is "at first quarter," although its cusps are facing in the direction generally associated with the moon at last quarter.

Beyond that point, the angular distance between Venus and the sun decreases constantly as the planet moves toward superior conjunction. We see an increasingly greater portion of the illuminated surface as it begins to pass beyond the sun. Its appearance is gibbous, similar to that of the moon between quarter and full phase.

At the time of superior conjunction, Venus is "full," since the sun now is located between Venus and the earth; but, unfortunately, this circumstance is of no avail to us, inasmuch as the planet is fully obliterated by the sun's glare.

After superior conjunction, Venus moves gradually east of the sun. It is gibbous once more, until it reaches its greatest eastern angular distance, or greatest eastern elongation, at which time it is seen at "last quarter." As may be presumed from the above, its appearance resembles that of the moon at first quarter.

Finally the planet enters its last crescent phase, as it begins to pass in front of the sun, and inferior conjunction is reached once again.

At inferior conjunction, the average distance of Venus from the earth is roughly twenty-six million miles, while at superior conjunction the distance is about 160 million miles—more than six times farther away. For that reason Venus appears to us more than six times bigger at inferior conjunction than it does at superior conjunction. On the other hand, as was shown above, we see a proportionately much smaller part of its illuminated surface when it is near us than when it is farther away. These effects of distance and of phase thus counteract each other. The greatest apparent brightness, also called the greatest brilliancy, occurs about thirty-six days before and after inferior conjunction, while Venus is still in a crescent phase.

Mercury is the only other major planet that may be seen in crescent phase, because it is the only other one that travels inside the orbit of the earth. However, its phases are less striking than those of Venus, because it is a smaller body, much farther away, and exhibits only a threefold increase in its diameter between superior and inferior conjunctions.

VENUS

The stars, that held high revel
Through watches of the night,
When dawn's first rays lie level
On rimrock, take to flight—
All but one, Morning's far
And clarion Star!

Ethel Jacobson

The New Moon will occur on June 6 and July 6, and the moon will be full on June 20 and July 20.

The summer solstice will be reached on June 21 at 6:50 p.m., eastern standard time. The earth will be in aphelion on July 5 at 2 a.m., eastern standard time. On that date it will be farthest away from the sun in its yearly course.

Mercury will be in superior conjunction with the sun on June 2, and will remain poorly placed for observation until the latter part of that month. It will reach its greatest eastern elongation on July 8, and may be seen as an evening star, low over the northwestern horizon, for the first few days of July. It will set one hour and fifteen minutes after sunset on June 15, one and one-half hours after sunset on July 1, one hour after sunset on July 15, and at sunset by the end of July.

Venus will be a very brilliant evening star, and the most conspicuous object in the western sky after sunset. It will reach its greatest eastern elongation on June 23 and its greatest brilliancy on July 26, when its magnitude will be −4.2. Up in the west at dark, it will set three hours after the sun on June 15, two and one-half hours after the sun on July 1, two hours on July 15, and one hour and fifteen minutes on July 31. On June 14, it will be less than a degree away from Mars.

Mars will remain rather inconspicuous (magnitude +2.0) as it gradually moves to the point farthest from earth on its two-year orbit around the sun. It will set about three hours after sunset on June 15, two and one-half hours on July 1, one and three-quarter hours on July 15, and one and one-half hours on July 31. In the month of June, it will be found in the constellation of Cancer, moving gradually toward Leo, where it will be found in July. It will pass north of Regulus in mid-July and will be east of that star by the end of July.

Jupiter (magnitude −2.0) in Libra, will have risen by sunset. It will set just before sunrise on June 1, around 1:30 a.m. on July 1, and at about midnight on July 31.

Saturn (magnitude +0.3), in Sagittarius, will rise in the southeast two hours after sunset on June 1, and will remain visible all night. On (*Continued on next page*)

June 15, it will rise a few minutes after sunset and will be due south at midnight. On July 1, it will rise at sunset and set at about sunrise. During the month of July, it will have risen by sunset and will set about one and one-half hours before sunrise on July 15, two and one-half hours before sunrise on July 31.

The Delta Aquarid meteor shower is expected in the early evening on July 29, with a maximum zenith rate of ten per hour. A few Perseid meteors already may be seen by the end of July, mostly after midnight.

Leaf Music

A COLLECTION of references I have made to the sound of wind among leaves is incomplete because it was not begun soon enough. And one cannot go back over all of the books he has read! There are numerous passages in literature on the murmuring, sighing, or rustling of leaves in the wind, but what I sought was something specific, with the idea that each kind of tree, or other wind-blown plant, might have its own recognizable note.

John Muir has written entertainingly on the subject, and in a chapter entitled *A Windstorm in the Forest*, says: "Even when the grand anthem had swelled to its highest pitch, I could distinctly hear the varying tones of individual trees—spruce and fir, and pine, and leafless oak—and even the infinitely gentle rustle of the withered grasses at my feet. Each was . . . singing its own song." This points to my thesis, but he does not contribute much in the way of concrete illustration. He refers to "the quick tense vibrations of the pine needles, now rising to a shrill, whistling hiss, now falling to a silky murmur; the rustling of the laurel groves in the dells, and the keen metallic click of leaf on leaf," and attributes to the western yellow pine a "free, wing-like hum."

Most of the comparisons for leaf sounds are drawn from those of water. However, here is an exception. Mary Nelson Carter writes: "Above all droop the brown oaks, clutching fast their dying leaves, which they mean to flaunt through the winter in the face of raging snowstorms, and to rattle like castanets in the teeth of the wind."

The aspens and poplars have long, slender leaf-stalks, laterally flattened near the blades, that permit free and easy motion so that the leaves are seldom still. In proportion to the strength of the wind, the sound they make (in the Carolina poplar, as I have observed) varies from a low to loud breathing, accompanied by a clattering that in a strong wind sounds like the patter of heavy rain as it advances over a forest. One poet agrees with me, referring to:

"The cottonwood the wind plays on,
Simulating rain"
(Marie L. Delesdernier)

Others prefer the simile of waterfalls:

"and aspen trees that sound
As soft as water at a fall"
(William Barnes)

"I know five poplars on an inland hill
That murmur always with a mournful sound
Of distant waterfalls"
(Centaur)

"There's a rushing sound in the poplar tree
. . . . .
The lulling sounds together all
Are like a dreamy waterfall
. . . . .
But when another gust shall pass
The waterfall will foam and splash."
(Henry E. Pilkenton)

The pines with slender needles make sibilant sounds, which in mass effect, have been most often compared to surf.

"Blow, O winds
Against my pine trees
And I shall hear the swish
Of ocean waves."
(Ada Neill Clark)

"A noise like the rustling of a host,
Or like the sea that breaks upon the shore—
It was the pine-trees' murmur."
(Richard Watson Gilder)

". . . . . on that sea-cliff's verge,
Whose pines, scarcely travelled by the breeze above,
Had made one murmur with the distant surge!"
(Samuel Taylor Coleridge)

A related comparison serves for the leaf music of the hemlock, according to Charles Warren Stoddard:

"O, when I hear at sea
The water on our lee
I fancy that I hear the wind
That combs my hemlock tree.
"But when beneath that tree
I listen eagerly
I seem to hear the rushing wave
I heard far out at sea."

And now for wind sounds in two grasses:

"Small fountains played into a pool
With sound as soft as the barley's kiss
When its beard just sprouting is."
(Lascelles Abercrombie)

Mocked the wheat to the wind:—
Kiss me! Kiss me!
(Walter De La Mare)
That seems the best try of all.

W. L. MCATEE

Bulletins

"Horticultural Magazines and Plant Society Reports" is a mimeographed 10-page list of publications of interest to amateurs, commercial growers, teachers, plant breeders, research workers and professional and technical workers dealing with plants. This valuable reference list was compiled by L. A. Dougherty, extension economist in marketing, of the Cooperative Extension Service of the University of New Hampshire at Durham, N. H., from which department it may be obtained.

Nature IN THE SCHOOL

By E. LAURENCE PALMER

Professor Emeritus of Nature and Science Education, Cornell University, and Director of Nature Education, The American Nature Association

A Question of Judgement

ON APRIL 4, 1959, AT THE Seventh National Convention of the National Science Teachers Association, a Department of the National Education Association, Angelo C. Alaimo of Kensington High School in Buffalo, New York, presented a paper entitled "Demonstration of the Latest Mouse Smoking Device for Studies of the Relation Between Cigarette Smoking and Lung Cancer." Apparently, the project described had been stimulated by a summer fellowship in cancer research at the Roswell Park Memorial Institute in Buffalo. Following this, the high school teacher had transferred the attitudes, methods and objectives, which may have been proper in an upper echelon research laboratory, to his high school classroom with little or no modification. Was he right in so doing?

The study was recognized as being one of the winning entries in the 1958 Science Teacher Achievement Recognition Program. It was one of fifteen entries to win awards of $250 or more. It had been reported in an elaborate brochure entitled "Will Cancer Be Conquered in the High School Laboratory?" published by the National Science Teachers Association and edited by Abraham Raskin, Professor of Physiology and Coordinator of the Sciences (Science Teacher Program) of Hunter College in New York City.

Students helped

According to the report, high school students helped develop a device by which they were able to force white mice to inspire "noxious materials that might provoke the violent shutting off of the glottis," in spite of the fact that "a mouse can hold its breath for almost three minutes against noxious inspirations." The students apparently traced in the mice mixtures of starch and pepper and plan to use the smoke of radioactive cigarettes.

The students worked on more than a dozen projects dealing with this smoke-mouse study. They helped develop the device that forced the mice to smoke. They induced tumors in the tails of their mice, operated to remove tumors, removed the gonads to observe if this had any effect, and intend to experiment with other glands in the future. They injected cancer cells into living mice and studied the effect of chemicals on what happened in the lungs. Eventually the work done by the teacher in the research institute was transferred completely to the school laboratory.

This high school laboratory prides itself in making "as great a variety of living specimens as possible" available for use by the students, and many students "have taken mice and other animals home to use in experiments conducted in their own rooms or basements." The teacher reports that "after the first few weeks of school there is an amazing absence of squeamishness or fear."

Among other things, the teacher reports: "We never give names to our animals. I prefer to have the pupils develop an impersonal and objective attitude towards them. It is too easy to become emotionally attached, and thus become strongly disturbed at seeing a 'friend' handled directly. This objective attitude enables us to make use of many animals in our work." I cannot refrain here from reminding Mr. Alaimo, and those who have applauded his work, that Buchenwald, of which he must have heard, was the temporary and terminal residence of thousands of human beings for whose names their captors substituted numbers. Greatness and success do not come alone to those who sacrifice compassion to objectivity.

Question of benefit

You may say that all of this work is directed towards the solution of a major problem of the day, and that no one would hesitate to sacrifice if it was known to be of benefit to man. Here I simply cannot refrain from personal views and experiences. The useful study of cancer by anyone is of major importance to me. I have lost a number of my closest relatives to the disease. Four years ago my physician told me that I unquestionably had it. I know only too well the terrifying fear that comes to one who alone faces up to the fact for the first time that he has a fight on his hands, and there you are alone at night fastened tightly in a hospital bed. Almost anything *that will be effective* in understanding and controlling cancer is, so far as I am concerned, worthy of encouragement.

Situation mastered

Fortunately, in my own case, I believe that the situation has been met and mastered. I have no fear whatever that I am more likely to die of that disease than of any other. I also hope that we will recruit into our medical profession the highest quality of manhood and the best minds to fight cancer. Two of my close relatives were successful physicians and surgeons. For two or three decades I was closely and dynamically associated with top-notch physicians and surgeons from coast to coast. Almost invariably I have been impressed by the compassion these professional folk have shown genuinely for their patients. I question whether the program of Mr. Alaimo—lauded by the National Science Teachers Association as appropriate for high school students—will develop the kind of person who will do an effective job here. I hope that our teacher training program never becomes dedicated to the task of making even doctors into automatons with a wholly "impersonal and objective attitude" towards any warm-blooded animals. Certainly let us not deliberately wipe out sympathy at the high school level.

The situation created by this high school program is not of local significance. A report of the original awards reached England. It was reprinted in Great Britain. Three important individuals there were instrumental in calling the story to my attention. I wish I might quote their mimeographed and written commentaries in full. They objected particularly to the fact that the situation resulted in surgical procedures becoming "especially

thrilling to the pupils," and felt that the cause might well be the "quasi-adolescent attitude of the teacher." They wrote that they were "startled and to put it frankly shocked that what seems to be a responsible body should encourage children to perform " these kinds of experiments on live animals. Their official group took published exception to at least ten aspects of the situation. I know at least one of these English critics well, and he is far from being a namby-pamby crackpot. He is a well-trained and dedicated leader.

I also have much respect for the National Science Teachers Association and Executive Secretary, Mr. Robert Carleton, bat feel that this time they missed the boat. My local paper, *The Ithaca Journal*, on April 4, 1959, carried on its front page center a large Associated Press wirephoto of the mouse smoking gadget made by Mr. Alaimo. It indicated that it was of the "Rube Goldberg" type, overlooking the points raised in this commentary, with the possibility that it might have some Mephistophelean qualities. I assume from this Goldberg reference that we were supposed to laugh at what was done, but I question whether our English friends will be able to see the point of this American "joke." Maybe we should reexamine our concept that Englishmen cannot see a joke, and examine ourselves. I do not remember any great roar of laughter on either side of the Atlantic over the Buchenwald experiments that started with taking the names from human beings, giving them numbers and then, in the name of science, carrying on some experiments that shocked the world. The director of the Roswell Park Memorial Institute, which sponsored the original study, flattered Mr. Alaimo and, apparently, the awards committee of the National Science Teachers Association, when, rather ungrammatically, he wrote on February 13, 1958: "We have discontinued using our own model and awaiting the perfection of your improved apparatus." Personally I hope that high school science teachers of biology generally will not follow the educational pattern outlined by Mr. Alaimo, even though it was rewarded by adoption by a State-supported research institution in New York, commented on favorably by the National Cancer Institute and chosen as one of fifteen of the best of 369 entries for recognition as good teaching in "every part of the United States, representing schools both small and large, and public as well as private and parochial schools."

In all this glory let us not forget what the program may be doing to the youngsters themselves, even if we can forget the mice; and other animals. Let us hope that we can forgive these educational Solomons for, we believe, they "know not what they do."

Secondary Biology Course

The American Institute of Biological Sciences, Washington, D. C., has announced a unique collaboration of the nation's leading biologists to produce a secondary school biology course that makes integrated use of more than 120 half-hour film lecture-demonstrations, classroom teaching and printed materials for students and teachers. More than 100 biologists from both research and teaching posts in secondary schools and colleges are now preparing the course, which is expected to be ready for use in the fall of 1960. Funds to support preparation of the project have been made available by the Fund for the Advancement of Education of the Ford Foundation.

The primary aim of the project is to provide the most help possible for the greatest number of high school biology teachers, according to Dr. Oswald Tippo of Yale University, who is chairman of the project's Steering Committee. "This will not be an educational 'cure-all' ," Dr. Tippo pointed out, "and must not be thought of as a replacement for the 'live' teacher in the classroom." Materials that will be made available by a distributor to high school teachers will be the 120 lecture films, either individually or in topic groups, student study guides, teacher manuals, discussion questions and suggestions for field and laboratory work, a reference work, a reference manual and glossary, and examinations.

Bulletin

"Forest Service Films" is, as the title suggests, a listing of 16- and 35-mm films that are available from the U. S. Forest Service on loan for educational purposes to schools, civic groups, churches and television. Ten cents, from the Superintendent of Documents, Washington 25, D. C.

THE Nature CAMERA

By EDNA HOFFMAN EVANS

Photographers' Spring Cleaning

MANY NICE THINGS HAVE BEEN SAID about the month of June, but I think one of the nicest things that anyone can say is that June is the gateway to summer vacation. Perhaps your vacation does not begin until some time in July or August. But in June the kids get out of school, days are warm and nights are balmy. I like to think, too, that our everyday pace slows down somewhat, and we have a little more time to do some of the things we have been wanting to do.

Those of us who find fun in photography should look to summer as our special time. There are, of course, vacation pictures to be taken. But summer is the season, too, when we should find the time to do some of those other photographic chores.

For one thing, we should do some house cleaning with respect to our photographic equipment. This might well have been an indoor winter job, but the truth is that we never got around to it. So now is the time to set your photographic house in order while the rest of the spring cleaning is in progress.

Camera comes first

Begin with your camera. How long has it been since you really cleaned the lens and the viewer? Use special lens paper for the job, and the lens cleaning fluid that you can buy at any photo supply shop. This is a job well worth doing, and afterwards you should detect results in sharper pictures because of a clean lens, and better viewing and focusing. Your filters may need cleaning, too, so treat them as you did your lens.

Do not stop here. Open your camera and look for dust. If there is any, remove it carefully with a fine-haired brush. Be sure, when you finish, that you have left none of the brush hairs inside. Also, look for bits of film that may have torn off as you wound or re-wound over the sprockets.

The outside of the camera can probably use a cleaning. Wipe the metal parts carefully and polish the plastic portions; if your camera has a leather or pseudo-leather covering, polish that, too. You might look to the tiny screws that hold the camera together—some of them may need tightening with an appropriately small screwdriver. But remember that your camera is a delicate precision instrument. You can clean and polish and dust it inside and out, but any repairs or adjustments should be left to the experts.

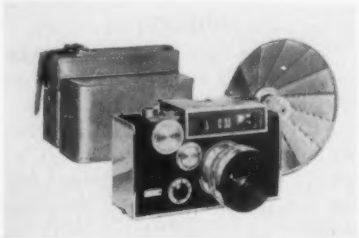
Never take the lens elements apart, never tamper with the shutter, and never try to oil your camera, although you may think that it needs lubrication. You would not try to oil or repair your watch, would you? Neither should you make such attempts with your camera. In the event that major repairs are needed, you may have to send your camera back to the factory. This takes time—an exasperatingly long time, in some cases. If this happens, I hope you have a second or auxiliary camera to use while the first camera is away.

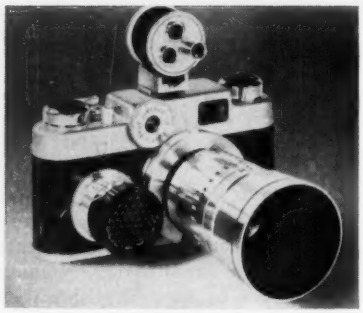
The carrying case

Next, pay attention to the case in which you carry your camera. This takes a lot of hard usage and absorbs a good many knocks and scratches. Clean it well with saddle soap. This will serve to soften and preserve the leather.

Look to the straps and the fastenings on your carrying case. These, too, will crack, wear thin, loosen, or tear as a result of long and hard usage. Replace weakened straps before they give away, as such a break could cause great damage to your camera. Stitching may need to be renewed or rivets replaced. Take the case to a handbag hospital or a good shoe repair shop and let the leather craftsmen there do a professional job of repairing.

This Argus C33 model may be used with accessories that include "magic eye" coupled exposure meter, wide-angle and 100 mm. telephoto interchangeable lenses, zoom viewfinder, and folding flash unit.





The Argus Rapid-Wind C44 camera has the new CM2 coupled exposure meter (left), a turret viewfinder for multi-lens viewing (top), and a 100 mm. telephoto lens.

Check the batteries in your flash gun. Are they still strong and full of energy, or are they tired and nearly worn out? If so, they may fail you when you are particularly anxious to get a good flash picture. Check connections, too. Some cords have a special weak spot at the point where they join the plug. It may be that you will need some replacements in the flash department.

Your gadget bag may need an overhauling. Mine collects things. Despite the fact that I need every bit of space for my equipment, empty film boxes, wrappers and exposure information, a burned flashbulb or two and other odds and ends will accumulate. They need to be edited out now and then or they would eventually monopolize most of the space in the gadget bag.

With your equipment well cleaned and in good working order, you should get good results with your pictures this summer. And, while you are at it, try to keep your equipment as clean and dust-free as it is now. Never leave your camera open or your lens uncapped. If you get caught in a summer shower or are doused by salt spray, be sure to wipe your equipment dry before putting it away.

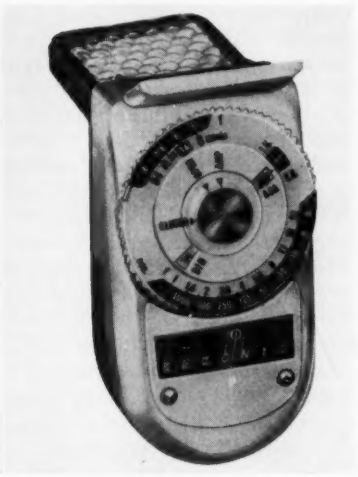
Pre-vacation time in summer is a good time to try out new equipment. It is never a good idea to buy a new camera or other important photographic item on the eve of your departure on vacation. Regardless

of how experienced a photographer you are, you probably will need to do some testing of new equipment. Shoot several rolls of film, using your new camera. Check your results carefully to be sure you are doing the right thing to get the results you desire.

Many new items

Photo-equipment companies have been active recently, perfecting and offering numerous new items to the amateur market. The following are some of them, particularly those that would be useful in vacation time photography.

For color fans, Eastman Kodak has promised that a new high speed Ektachrome film will be available this month in 20-exposure rolls for 35mm. cameras. Its ASA rating of 160 is five times faster than that of regular Ektachrome. The new film is intended primarily for special purposes requiring extra-high sensitivity. For normal picture-taking



This light meter, the Sekonic L-38, is Japanese made and retails at $11.95.

situations, Kodachrome and regular Ektrachrome are still expected to be the photographer's mainstay. But, with summer coming on, here is a fine chance to do some experimenting.

The Japanese, who have made great strides in camera production, are now in the exposure-meter field, too. The Sekonic Electric Company, of Tokyo, now has six different meter models on the market, the latest being the L-38, priced at $11.95, including leather case and neck cord.

This meter is designed for reflected light measurement only. It has a hinged flip-up booster, a new Auto-Guide indicator, and two photoelectric cells that may be used either singly or in combination to provide correct exposure values for bright, dull, or dim levels of illumination. Distributors of these meters are Scopus-Brockway Inc., 404 Fourth Avenue, New York 16, N. Y., and Ponder & Best Inc., 814 North Cole Avenue, Hollywood 38, California.

More and more cameras are coming to the market with built-in features, including "magic-eye" exposure meters. Among the newest of these are the Argus Rapid-Wind C44 and C4, both of which have the new Argus CM2 meter coupled directly to the shutter speed dial of the camera. All the photographer has to do is set the desired shutter speed on the meter, and this automatically adjusts the camera's shutter.

The Argus coupled exposure meter is available as an accessory at photographic stores at a list price of $19.95. A leather case for carrying the Rapid-Wind C44 or C4 cameras with the meter locked in position is listed at $14.50, while a case for the meter alone sells for $2.95.

Another Argus model, the C33, can be fitted with the following accessories; "magic-eye" coupled exposure meter, 35mm. wide-angle and 100mm. telephoto interchangeable lenses, zoom viewfinder, and folding flash unit. Base price for the camera is $89.95, plus $10 for the leather carrying case. Accessory prices are: meter, $19.95; wide-angle lens and telephoto, $49.95 each; zoom viewfinder, $15.95; and flash unit, $9.95.

That "magic eye"

Eastman, too, has entered the "magic-eye" field with the Brownie Starmatic camera. This model has a built-in photoelectric cell that controls exposure automatically. The camera also has five non-automatic settings that permit flash at long and short ranges, and also allow for special effects in daylight shots. Priced at $34.50, the Starmatic takes 127-size roll films for both color and black and white.

In a higher price range ($84.50) the Kodak Automatic 35 camera also has a photoelectric exposure meter that measures the light and controls the lens opening as the shutter release is pressed. The camera focuses from infinity to two and one-half feet, and has two

shutter speeds, 1/40 and 1/80. This camera has so many automatic features that one wonders whether an operator is necessary at all.

And finally, in the movie field, the "electric-eye" is becoming more important than ever. Argus Cameras, a division of Sylvania Electric Products Inc., have entered the movie field with two new 8mm. cameras — the "electric-eye" Cinetronic M3, and the Match-Matic M3 with a simplified system for quick exposure setting. Both feature three-lens turrets with true-image optical viewfinders for each individual lens.

The Match-Matic camera was scheduled for the market early in June, at a price of $99.95. The Cinetronic M3 will be available in August, according to company predictions, and its price will be $149.95.

Bell & Howell, already on the market with a line of electric-eye movie cameras, has announced improvements in these to meet projected faster color films for movie cameras. In addition, the company also has announced the use of a new indexing-type light meter with its line of Sunometer cameras. To operate the new meter, the photographer presses a small red button while pointing the camera toward the subject to be photographed. The reading is "locked" into place when the button is released, and the photographer merely adjusts the camera dial to match the meter reading.

So, whether you try out some of these new devices, or merely give a good summer's workout to your old equipment (as I intend to do) here is a wish for one and all: May you have a happy summer of photography!

Environment

(*Continued from page 320*)

There being no difference in light intensity at different altitudes, it became evident that temperature, which is so intimately connected with growth, and length of season, which determines how long growth is possible, must play a large and perhaps leading part in such alpine dwarfing. It is not due to low water content in the soil.

In the experimental gardens, when alpine species were transferred to the montane or plains climate, they changed only slowly or but little unless they were placed in shade or in extremes of soil-water. Montane species, transferred to 12,000 feet altitude, without exception have undergone marked reduction. Typical is the black-eyed susan, *Rudbeckia hirta*, that normally grows to a height of two to three feet at an 8000 feet altitude but which, when transferred to the gardens at 12,000 feet, appeared as a plant only two to three inches tall, with a few small, hairy leaves and a single head with rays greatly reduced in size and number.

Similar dwarfing occurred during a very dry summer, when stunted forms of black-eyed susan appeared at the mid-alpine station. One plant, growing in dry gravel in the sun, had no stem and had rough, hairy leaves and two sessile flowering heads, while in dry shade another plant had a well-developed rosette of large leaves and a single stemless flowering head. This drought period also brought about noticeable dwarfing in a number of mid-alpine species.

Although no experiments could be made with the effects of different altitudes at the coastal laboratory in Santa Barbara, plant species grown there during the winter months yielded much additional evidence as to the part environment plays in changing them, and it seems safe to say that this "great body of evidence" would have confirmed Darwin's later views as to the origin of species!

New Wild Area

Establishment of the first wild area in the Eastern Region of the U. S. Forest Service is foreshadowed by a Service announcement of intention to set aside the Great Gulf Wild Area in the White Mountain National Forest. This is a 5400-acre glacial valley, one of the distinctive features of the eastern slope of the Presidential Range. It is rough and steep, containing a number of remarkable cascades and splendid views. It is traversed by a number of foot trails, but remains rugged and wild, the slope and surrounding peaks shut in the valley and establish the feeling of remoteness. If the classification of the area is approved recreation structures will be limited to simple Adirondack-type, open-front lean-tos, and closed-in refuge huts above timberline. No tractor or jeep trails or roads will be permitted.

Conservation Advertising

Sinclair Oil Company's series of advertisements devoted to American conservation and to organizations and influences in this field, are doing a great service in carrying the conservation message to a large audience. Currently in *Nature Magazine*, and elsewhere, Sinclair salutes The Natural Resources Council of America, of which the American Nature Association is a founding member. Although the advertiser can not put his finger on specific results of such advertising, he recognizes the responsibility of industry to our natural resources and to their wise use and conservation. We are certain that Sinclair enjoys the patronage of the considerable army of conservationists. It is to be hoped that other large corporations will see the value and wisdom of a similar approach.

Nature Conservancy

Graphically emphasizing the accomplishments of the Nature Conservancy of Great Britain is a most attractive, 36-page illustrated booklet issued in observance of ten years of the existence of this organization. The booklet shows that scientific studies account for about one-half of the current annual expenditure of 350,000 pounds, about four shillings in the pound going for Nature Reserves. A copy of this publication, which may be had for fifty cents from The Nature Conservancy, 19, Belgrave Square, London, S.W.1, England, should be an inspiration to conservationists in the United States.

Bird Refuge Acquired

Recently acquired by the Florida Audubon Society is a man-made islet in Lake Sherwood, Orange County, Florida, for a least tern sanctuary. The island, three hundred feet long and a hundred feet wide, has previously been favored by least terns as a nesting site, and will be posted, supervised and managed by the Florida Audubon Society as the Tern Island Sanctuary. The least tern, notes *The Florida Naturalist*, the Society's monthly publication, was close to extinction in the early 1900's because of the activities of bird, plume hunters, but has since been increasing in numbers, with small colonies now located from New England to Florida. The eggs of the least tern are laid in a nest that is only a scrape in bare sand.

Nature IN ROCK AND MINERAL

By PAUL MASON TILDEN

Mineral of Many Uses

IF WISHES WERE automobiles, there would be far fewer "hitch-hikers." And if the mineral fluorite were only a little harder, all the amateur gem cutters would enjoy a field day.

But this is not to be. The beautiful mineral fluorite—often called fluorspar—will always be something for collectors to look at rather than a gemstone for the ladies to wear. Running mentally through a list of your favorite pastel colors, you could probably find a fluorite crystal to match the hue of any of them. Pale blue, soft green, rose, violet, green, yellow—almost any shade of every color characterizes this simple, happy wedding of the elements calcium and fluorine.

The elemental parents of fluorite are about as far apart in their physical characteristics as two elements could possibly be. One is a shining, yellow-tinged light metal with a great affinity for oxygen, while the other is a sickly-looking, yellowish-green gas with a facility for chewing up otherwise indigestible mineral items like quartz and asbestos. The two elements have one point in common—they are both somewhat inclined towards violence when mishandled by the unwary.

Menace to life

Of the two, fluorine is probably capable of being the greatest menace to the animal world—human and otherwise—entering into the composition of such potent poisons as sodium fluoracetate, whose shocking misuse and deadly after-effects as a biological control were recently described in a *Nature Magazine* article. (January, 1959: *Uncontrollable "Control"*). And a newspaper story tells us that liquid fluorine recently has been used successfully to increase the power of rocket engines by some forty percent, and that the use of this element in rocket fuels offers "the last major breakthrough in chemical rockets." The inclusion of this interesting tid-bit under the subheading "menace to life" is fortuitous; the reader will be left to draw his own conclusions as to the ultimate benefits of this scientific *tour de force*.

It is from these two somewhat unruly parents, however, that the mineral fluorite comes forth, a cabinet gem for the collector and a most strategic mineral indeed in the economy of the nation. Hundreds of thousands of tons of fluorite are used every year in the American iron and steel industry as a flux—a substance that facilitates the melting of ore, as the name of the mineral suggests—and as a scavenger of impurities in molten iron and steel; a remover of such unwanted elements as phosphorus and sulphur. Other thousands of tons of fluorite are used, after conversion to hydrofluoric acid, by the oil refining industry in the manufacture of high-octane gasoline, so it can truthfully be said that both our new cars and the fuel that makes them run lean heavily on the pastel-colored crystals for which, to quote one authority, "there are no adequate substitutes."

Diverse uses

Fluorite pops up in a wide assortment of other industrial uses as well. The finest grade of colorless, or nearly colorless, fluorite is sometimes used in the lenses and prisms of microscopes, telescopes, spectroscopes and other optical instruments. Needless to say, such fluorite must pass a rigid examination for transparency and freedom from even the most minute of flaws. Glass manufacturers consume a substantial quantity of fluorite, and such industrial products as welding-rod coatings, fiber-glass, steel enamels and concrete hardeners take their share of the mineral.

Many specimens of fluorite exhibit to a marked degree the phenomenon known as "fluorescence" when exposed to ultraviolet light, the so-called "black light." Essentially, fluorescence in any mineral is caused when the mineral re-radiates the invisible shorter wave-length ultraviolet light in the form of longer wave-length light that can be detected by the human eye. The atomic mechanics of this process, as might

(Continued on next page)

Fluorite, a simple combination of the elements calcium and fluorine, is one of the collector's favorite items and a most important mineral in the economy of the nation.

PHOTOGRAPH COURTESY WARD'S NATURAL SCIENCE ESTABLISHMENT

be imagined, are best left to the student of physics; but the rather surrealistic colors of a fluorescent mineral display warm the heart of many a collector even though their cause may be somewhat obscure.

Fluorite is commonly found throughout the world as a "filler" mineral in cracks and fissures of many different kinds of rocks. The United States, consuming more fluorite than any other country, also is blessed with the greatest commercial deposit of the mineral. A single area of some forty square miles along the Ohio River in southern Illinois and western Kentucky furnishes a large portion of all American production, and at Rosiclare, Illinois, in the heart of the fluorite producing district, miners have worked veins of this handsome mineral that were up to thirty-five feet wide!

ITEM

Not long ago police collared a fifteen-year-old boy in a town in one of the New England States for questioning regarding a broken window. The case for the defense looked gloomy when a large stone was extracted from one of the youth's pockets. But who can deny the never-ending miracle of coincidence? "My brother collects rocks," announced the young man. "He has a pile of them home and I'm bringing this one as a present." ⚘ ⚘ ⚘

Moose

(*Continued from page 317*)

Nor was there any furious battering at the little burnt-land spruce tree in which I took refuge. He did some pawing with his huge, black hooves, grunted a bit, and shoved with his head against the tree trunk. I was quite comfortable and unafraid, and I did not blame the moose for my predicament. It was entirely of my own creation. I studied the big boy, and talked to him. Less than ten minutes later he was pacing back into the woods.

Moose often loiter about pulpwood and lumber operations, traveling on the ploughed roads and well-beaten snow trails, sampling the horses' food and paying no attention to either men or activity. No one pays much attention to the so-called "bloodthirsty killers," either.

Hauling a long, light cedar frame sled loaded with kitchen supplies from a depot camp to a lumbering operation in Maine, I came face to face with a big, antlerless bull moose on a turn in the smoothly-ploughed tote road. Only thirty-five or forty feet separated us. The snow on either side was at least four feet deep. I did not care to get into it, and I suppose the moose shared my aversion. We stared at each other. I tried to frighten him by shouting and slapping my hands together. He walked toward me, head down, short neck extended. I tried walking toward him, my heart pounding, forehead sweating. I was ready to "take to the woods." Returning to the sled, I picked up a large tin biscuit pan and scaled it at him. It clattered noisily in the hard road and spun under his hooves. Up went the big head and away the moose ploughed through the deep snow into the woods!

A moose, blinded and bewildered by headlights or bowled over by automobile or train, usually is accused of having attacked the vehicle in a headlong charge. Only on rare occasions have I known an unmolested moose to attack the lights of an automobile. Such collisions may easily be avoided, however, by pulling to the side of the road when the moose is sighted, and snapping off the headlights. The moose will soon be on his way.

Many fine moose are lost every year as a result of such accidents in many parts of its remaining range. Fierce, locked-antler battles between bulls during the mating season account for many more deaths. Rare indeed are the occasions when humans witness such wilderness struggles. Equally rare is the finding of the tightly locked antlers that mark those battlegrounds.

Like other forms of wildlife, the moose needs only to be left alone. If its natural habitat is preserved, his majesty the moose will always be with us as a living reminder of our early North America. ⚘ ⚘ ⚘

Pacific Coast Survey

Conducted with donated funds, an intensive 18-month study was made by the National Park Service to determine the remaining opportunities to preserve unspoiled natural seashore areas along the Pacific Coast of the United States for public recreation purposes. The study revealed that 1448 miles of seashore are not in public ownership, but that of this mileage 527 miles possess important opportunities for recreation and use for other public purposes. The results of the study are condensed and published in a 208-page report (plus maps) entitled "Pacific Coast Recreation Area Survey." Sections of the coastline specially desirable for preservation are pictured and described. It is to be hoped that the guide lines thus established will soon be followed by moves for preservation before it is too late.

Research in Conservation

Reproducing on its cover the wildlife and forest conservation stamps of the Post Office Department, *The Bulletin for Medical Research* of the National Society for Medical Research, 920 Michigan Boulevard, Chicago 5, Illinois, entitles its entire January-February, 1959, issue "Biological Research in Conservation." Contributors include Arthur B. Meyer, "Conservation as a Profession;" "The Field of Wildlife Diseases," Carlton M. Herman; "Fishery Research and Conservation," Paul E. Thompson; "The Patuxent Research Refuge," A. L. Nelson; "Conservation Biology — Facts & Fallacies," Durward L. Allen. Copies are available at 25 cents, or less in quantity.

Indiana Dunes

Attempts to save the last remnant of the Indiana Dunes on Lake Michigan's shore will not cease until all hope has fled, although pressures from private industry and local chambers of commerce appear to estop Senators and Congressmen from Indiana from lending any support. The preservation fight is being led by Senator Douglas of Illinois. In connection with the Save the Dunes drive we recently came across an entertaining little booklet entitled "The Chronicle of the Befogged Dune Bugs" by Irma R. Frankenstein. It adds a touch of personality and humor to the struggle. Copies are available at $1.10 postpaid from the author's daughter, who is thick in the dunes fight, and lives at Route One, New Buffalo, Michigan.

Bulletin

"Ward's Biology Newsletter" No. 22 of February, 1959, is a catalog and price list of a number of biological items—laboratory animals, slides, microscopes and equipment—available from the famous old firm of Wards National Science Establishment, whose address is Box 1712, Rochester 3, New York. For the teacher and the student of biology.

THE Nature MARKET

Classified advertising rate — 25 cents a word each insertion; minimum $5.00, cash with order. Abbreviations, initials, and numbers count as words. Discount, 3 times, 5%; 6 times, 10%; 10 times, 15%. October issue closes Aug. 20. Mailing date Sept. 20.

Northway Committee

Citizens of New York State who are concerned over the proposed route of the Northway through the eastern Adirondack Mountains and its threat to the State Forest Preserve are invited to join the Citizens' Northway Committee, for which an application blank may be secured from the Committee's treasurer, Mr. Lawrence H. King, 1759 Wendell Avenue, Schenectady 8, New York. Prime purpose of the Committee is to coordinate efforts of interested citizens for the defeat of the proposed State constitutional amendments for the Adirondack Mountain route. The Committee points out that a satisfactory alternate route is available.

Two New Refuges

Recently approved for establishment as migratory bird refuges have been Mackeys Island National Wildlife Refuge, an area of 7856 acres in North Carolina and Virginia, and Modoc National Wildlife Refuge, 6049 acres in California, announces the Fish and Wildlife Service in Washington, D. C. Mackeys Island attracts and holds a wintering population of greater snow geese, a protected species, and the Modoc Refuge has a nesting population of Great Basin geese as well as some ducks, says the Service.

Awards Nominations

Persons desiring to submit nominations for the annual American Motors Conservation Awards of the American Motors Company should do so by October fifteenth, according to Ed Zern, director of the Awards Program. Ten awards, each consisting of $500 and a bronze plaque, go to professional conservation workers employed by non-profit organizations, and ten awards of bronze plaques go to non-professional workers. An effort is made to select nominees whose work is not ordinarily given public recognition, but who typify the best traditions of those who work in the front lines of the conservation movement. Winners will be announced about November 15. Director Zern's address is 595 Madison Avenue, New York 22, N. Y.

Nature AND THE MICROSCOPE

By JULIAN D. CORRINGTON

The Leaves of Pines

THOSE WHO HAVE GIVEN NO THOUGHT to the matter might conclude that oaks have leaves but that pines do not. However, the pine needle is a leaf in every sense, and sections of these organs will demonstrate that fact. A leaf is a food factory equipped with its own transportation system and, whether in broad-leaved trees or evergreens, the tissues are much the same. The pine needle is a xerophytic leaf (one adapted for dry climates) of a special type for a special situation; not the desert in this case, but the cold, dry, northern winter, where the obtaining of water from a frozen soil is a matter of difficulty, and that which can be had must be conserved and not wasted by transpiration.

As seen in our illustration, there is a single outer layer of cells in a cross section of a pine needle, constituting the *epidermis*, heavily cutinized as a protection from the weather. Here and there are *stomata* (L., mouth; singular, *stoma*), the breathing pores of the leaf, each with two sunken *guard cells* that regulate the diameter of the opening. These interrupt the next layer, the *sclerenchyma* or *mechanical tissue*, which varies in thickness from one to several cells, elongated in the long axis of the needle. These cells have very thick walls and serve as a skeleton for the leaf.

Next inward comes the principal tissue, the *chlorenchyma* or *mesophyll*, with several rows of compactly arranged cells whose walls have a number of shelf-like infoldings that greatly augment the cell wall area, and hence the distribution of chloroplasts along these walls. Here occur the photosynthetic operations of the leaf, manufacturing food for the entire tree.

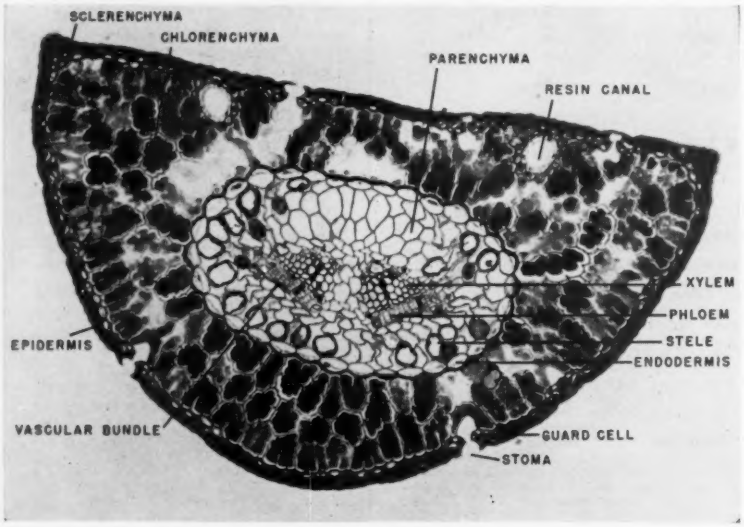
A central *stele*, containing the vascular tissue, is set off by a single layer of cells of the *endodermis*, within which are numerous simple cells of the *parenchyma*, a filler or background tissue. There are two *vascular bundles*, in each of which the thick-walled *xylem*, composed of *tracheids*, faces the flat side of the needle, while the thin-walled cells of the *phloem* face the convex side. These bundles are continuous with those of the stem, as are also the several *resin canals* observed in the chlorenchyma. The tracheids of the xylem conduct water, the sieve tubes of the phloem conduct food.

Pines have two kinds of leaves. There are small, brown, scale leaves, such as those that enclose a terminal bud, and the green foliage needles, borne at the ends of spur branches. Such branches are very short and slender, and die or fall from the tree when the needles are shed. A spur branch bears two, three, or five needles, according to species. Austrian and Scotch pines have two, white pine has five. In a two-needle species the leaf has the shape, in section, of a plano-convex lens, the curved side being the outer surface, whereas in pines having three or more needles per cluster there are two flat inner sides. Those species with two or three needles per cluster comprise the hard or yellow pines, those with five the soft or white pines.

In the preparation of sections, needles are gathered into a bundle, imbedded, and sectioned together. The safranin-fast green staining technique is commonly used. Good sections may be obtained by the free-hand method or in a well microtome.

Cross section of pine needle, 135X.

(PHOTOMICROGRAPH FROM SLIDE LOANED BY WARD'S NATURAL SCIENCE ESTABLISHMENT)



Beginner's Primer

Introduction to Ants

PHILOSOPHER and scientist—often at odds as to the meanings of affairs concerning life and the universe—are in agreement as to the ultimate domination by the ant world. When man has run his course, as all species must, the ant will take over. Not a very pleasant prospect for the sons of Adam, yet one clearly indicated by all present scientific knowledge, even though not likely to occur next Thursday. No two creatures could possibly be more divergent in all respects than the ant, standing at the apex of the invertebrate world, and man, culminating the vertebrate blueprint for life. The ant is a bundle of vastly complex instincts, incapable of reasoning; a precision machine that can form an ideal communistic government, where no one is boss and everyone is boss. Man is the apotheosis of reason and ego, and never can perfect such a form of government by virtue of these very same attributes. Man dominates now, with his rational brain, but when his day is past, the age of instinct will begin. It is not, then, a purely abstruse and impractical problem to investigate the structure and be-

havior of the ant, as a basis toward understanding its complicated civilization, far ahead of ours in certain respects, as will be evident later in our discussion.

Of all organisms on earth large enough to be seen by the unaided eye, ants are far and away the most numerous. A single colony may number several hundred thousand individuals, and yet in your back yard or front lawn, lorded over by (let us say) four or five human beings, in the heart of a great city, you may discover *hundreds of colonies!* Ants occur everywhere, from the kitchen sink to the Arctic to the tropics, from the garage to sea level to the high mountains, from the pantry to the humid forests to deserts. Already they are the dominant form of life on earth in the matter of numbers.

Studying the ant

The average ant is so small that the microscope must be invoked to reveal its structure. And yet ants make very unsatisfactory whole mounts in the slide manufacturing technique. It is well-nigh impossible to mount a specimen in anything approaching a lifelike position; freshly killed or anesthetized individuals under a widefield binocular microscope will be much preferable as study material. If permanent mounts are desired, it is generally best to make separate slides of parts of an ant, as head, wings, legs. A thin longitudinal section of the adult is highly instructive, as are also sections of developmental stages—eggs in cleavage, larvae, and pupae.

Ants range in size from 0.5 mm to 25mm, and vary in color from black through brown to yellow and red. Their integument may be thin or thick, and leathery or brittle; it may be smooth or hairy or even spiny. The segmentation of the body is prominent and the head, thorax, and abdomen are quite distinct from one another. The head is large and so distinct from the thorax that one wonders how it can be possible for sufficient connection of nerve, vessels, and digestive tube to run through the extremely attenuate petiole between head and thorax. This is equally true of the slender stalk between thorax and abdomen, so that nowhere in the hexapod kingdom is the scientific name *insecta* (cut-into) so well exemplified.

The antennae are geniculate (elbowed), with the basal half (*scape*) of a single piece, and the terminal, bent half (*flagellum*) of 4 to 11 segments. The eyes are small, mouthparts normal, legs well developed. On the tibia of the foreleg is a *strigilis*, or antenna-cleaner, a comblike modified spur. Wings are present only on the kings and queens, and are simple in venation. After queens have mated they either rub or bite off their wings. The abdomen is the largest body region, but its segmentation is deceptive in that the first true abdominal segment (*epinotum*) is fused with the last thoracic segment, so that the first evident abdominal segment is actually the second. The connection between thorax and abdomen is the *petiole* (from its resemblance to the narrow connection in a plant between leaf blade and stem). In some ants this segment is followed by another narrow one, the *postpetiole*, and each of these slender divisions may give rise to an erect or inclined scale, very typical of many ants. The swollen portion of the abdomen that follows is the *gaster*.

There are seven abdominal segments in females, eight in males. Stings are well developed in some groups, vestigial and non-functional in others. In the life cycle, objects that most persons refer to as ant "eggs," widely used as food for small pet turtles and certain fishes or birds, are actually the pupae. The true eggs are very small, white to yellowish, and from oval to elongate, 0.5 mm or less in length. The larvae are slug-like grubs, without head or appendages; pupae are within cocoons in the lower ants, naked in the higher groups. It is the cocoon of the pupa that is mistaken for an egg. Our next installment will discuss the caste system, as brought to its biological perfection in the world of ants.

Book Review

Science and the Detection of Crime, by C. R. M. Cuthbert. Philosophical Library, 15 East 40th St., New York 16, 1958, $10.00. Pp. 244, plts. 15 (28 photos), figs. 9.

We have frequently discussed various aspects of this subject in our columns, and have referred the reader to specialized works, but this is the first publication we have reviewed that covers the whole field. The author, who writes easily and interestingly, does not intend his volume as a textbook of forensic science, but as a series of descriptions of the many special techniques developed by scientists associated with crime detection laboratories. Mr. Cuthbert is the man largely responsible for the formation and success of the Department of Forensic Science of the Criminal Investigation Department (C.I.D.) of New Scotland Yard, and today continues his interest by lecturing to students at the various detective training schools throughout Britain. Consequently, all expositions and case histories in this book are completely authoritative and well documented.

There are 17 chapters, somewhat spottily arranged: historical introduction (very good), the pathologist, serologist, chemist and biologist, physicist, toxocologist, theft and fraud, arson, bogus breaking offenses, documents, ballistics, abortion, drugs, criminal responsibility, alcohol and motor accidents, case histories, and some foreign laboratories. A brief bibliography follows.

The points made in each chapter are illustrated by case histories outlining the aid the author was able to render in celebrated investigations or trials. These accounts (one reviewer referred to them as "whodunits") liven up the book a great deal and ably reinforce the descriptive matter. The book is intended for the layman and also as an aid to police officers. It is repeatedly emphasized that a forensic labora-

tory is not an arm of the police force, and is designed to assist the courts, and not primarily the police, by the accumulation of evidence, and that the laboratory personnel are as much interested in establishing innocence as guilt. What they attempt to discover is the truth, no matter in which direction it may point, and to disclose that truth by means of scientific methods and data. The explanations of how technicians employ all of the elaborate instrumentation of science—spectrograph, infrared and ultraviolet lights, microscopes of many kinds, chemical tests, blood grouping, fingerprinting, and a host of other tests and measurements—is very well done and vastly interesting.

General Zoology, by Tracy I. Storer and Robert L. Usinger, University of California, 3rd edition. McGraw-Hill Book Co., Inc., 330 W. 42d St., New York 36, 1957, $7.50. Pp. viii, 664; colored maps front and rear, figs. 585, 11 in color.

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Natural Selection and Heredity. By P. M. Sheppard. New York. 1959. Philosophical Library. 212 pages. $6.00. Discussion of recent ideas on the mechanism of evolution in the light of modern genetics.

Invertebrate Zoology. By Victor Schechter. New York. 1959. Prentice-Hall, Inc. 530 pages. Illustrated. $6.95. A new textbook.

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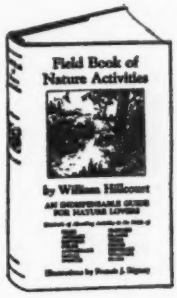

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